THE
ELECTRICAL REVIEW

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Electric Steel Production

Present-day Opportunities

QUALITY considerations govern the application of electrical energy in the form of heat to industrial processes. The fine control and the freedom from impurities which it makes possible are outstanding advantages that have, indeed, extended its scope still further, since many new processes can be carried out only by means of electric heat. The value of superior quality has, however, to be paid for by the relatively high cost of the BThU thus made available. This limits its field of usefulness, since the price is worth paying only in certain cases.

The number of cases in which the additional cost is justified is, nevertheless, very much larger than used to be generally supposed, judging by the growth of electric heating of various kinds in industry during recent years. At the beginning of 1936, it was estimated by Mr. W. S. Gifford that some 150,000 kW of furnaces was connected in Great Britain. There is evidence that before the outbreak of hostilities this figure had been more than doubled, representing an annual consumption which probably exceeded 900 million kWh, the equivalent of 8 per cent. of the total sold for power purposes.

A good deal more than that is to be expected when higher temperatures can be achieved in resistor furnaces. So far the alloy " Kanthal " has enabled us to go up to 1,350 deg. C., which has proved satisfactory for the heat treatment of stainless-steel strip and wire, although it has not displaced non-metallic resistors for such applications as the hardening of high-speed steel tools, but there is an important field at higher temperatures still.

Present Small Proportion

Then there are the great opportunities offered to electricity in the manufacture of steel. A paper of the type prepared by Mr. H. A. Sieveking, which was issued by the Institution of Electrical Engineers last week, is overdue, but it happens to be especially opportune at the present juncture. It is significant that the proportion of electrically produced steel to the total in 1918 (1.31 per cent.) was not exceeded in this country until 1937, the last year for which data are available, when it rose to 1.66 per cent. Alloy steels, which are required for many items in armaments, no doubt absorbed a large part of the 215,000 tons represented by the latter percentage, entailing an energy consumption in 1937 that probably approached 150 million kWh, and is no doubt appreciably higher this year.

Since it seems probable that much of the raw material now available will be a good class of scrap, the high-frequency furnace, which makes a far less onerous demand on the mains than does the arc furnace, should be in favour. If kept fully employed the absence of carbon pick-up and the saving in the cost of electrodes should sufficiently offset its high capital cost compared with that of the arc furnace. The view that it is unsuitable for refining seems to have been disproved by the results obtained by such concerns as Samuel Fox & Partners and Thos. Firth & John Brown.

Possible Large Increase

Apart from special alloys Mr. Sieveking sees the best prospects for commercial work in the manufacture by the hot-charge method of steel sections and plates (which form more than half of the finished steel output) in furnaces of the large size which the use of the arc makes practicable with its advantages of producing steel from crude raw materials to a rigid analysis. In view of the uniform structure of electric steel, his calculations of the possibilities based on the assumption that one-third of the tonnage of sections and plates is produced electrically seem not at all unreasonable. These would call for an additional load corresponding to more than 500 million kWh per annum.

While the coal resources of Great Britain favour the retention of large open-hearth methods and mass electrical production on the scale practised by means of hydro-electricity in Italy and Sweden is therefore not to be expected, it is clear that there still remains a wide field for exploitation in Great Britain. The smaller quantity of metal required to serve a given purpose with safety is of itself a valuable property, and should clearly be weighed in the balance in favour of electrically produced steel.

Having regard to the low average price necessary to secure a load of the magnitude envisaged and to the national reputation for producing the best steel, there is surely enough justification for regarding the circumstances as possessing the " exceptional nature " in virtue of which special terms can be quoted under the Act of 1935 by the Central Electricity Board to the supply undertakings concerned.

Commissioners' Concession

AN interesting and important item appeared in the agenda for this week's meeting of the Stoke Newington Borough Council. Reporting on the matter of loan restrictions the Electricity Committee stated that a representation was made to the Electricity Commissioners that the term "public need" should include the provision of facilities for lighting, cooking, water heating and similar facilities in private houses where they did not exist or had become inadequate for the needs of the occupier. The Commissioners had agreed and intimated that they would not feel precluded from sanctioning the borrowing of reasonable amounts in respect thereof. As a result of this, the Committee reported that applications for the provision of wiring and apparatus were now being accepted, but no canvassing was being done.

The I.E.E. Regulations

WE doubt whether Mr. E. A. Reynolds was quite serious in his expression of surprise that members of the Association of Supervising Electrical Engineers should find anything controversial in the eleventh edition of the I.E.E. Regulations. Be that as it may, those who took part in the discussion showed their usual aptitude for "getting down to brass tacks" and found so much to argue about that the lecturer had to curtail his replies to the many queries raised. Some of these related to inevitable difficulties of interpretation, others to misunderstanding of the provisions, but there were enough over of a really practical character to indicate possibilities of improvement in the next edition. We hope that, before this is due, all manner of opinions can be ventilated in an "Installation and Utilisation Section" of the I.E.E. This would at least give an opportunity of explaining the reasons for many doubtless very sound provisions that are not apparent to all who have to carry them out.

Insulating Oil

THE attack made by Mr. F. Meyer in his I.E.E. paper on the exaggerated value that has been attached in the past to sludge testing by itself as a means of classifying transformer oils will be received with sympathy by many, and a revision of B.S.S. 148 appears to be needed in the light of his investigations. Of equal interest is the information he gives regarding non-inflammable oils. Unfortunately their cost is too high to permit of their general use, but where small transformers have to be installed in such places as cinemas, this drawback may be outweighed by safety considerations. Nothing is said in the paper as to the possible effects of such oils on ordinary insulating material which are generally believed to necessitate modifications in design. Non-inflammable oils which have so far been developed are unsuitable for circuit-breakers as arcing causes them to give off hydrochloric acid, but we understand that different fluids giving freedom from fire risk are being developed in this country.

Wimbledon Tariff Case

WE report in this issue that judgment was reserved in the action brought by a Wimbledon resident against the Corporation challenging the legality of a two-part tariff based on floor area. As the matter is *sub judice* we are, of course, forbidden to comment on it, but we may be permitted to point out that in the course of the proceedings Mr. Justice Simonds said that he did not propose to accede to the plaintiffs' claim that a two-part tariff was, *per se*, illegal. What he had to consider was whether the plaintiff (Major Stevens) got his supply on terms to which the statutes entitled him.

The Magnetic Mine

FROM the more sober of the statements that have been published regarding the so-called "magnetic mine," it would appear that the mine is anchored to the sea-bed and that a delicately balanced magnetic needle or pin is caused to turn on its axis by the presence of a ship, this movement operating to explode the mine. This arrangement is technically feasible, but (if it does in fact define the essential feature of the mine) an immense amount of experimental work must have been required to develop a reliable construction involving much delicate mechanism. We have had an opportunity of ascertaining the views of Dr. T. F. Wall, of Sheffield University, who points out that the limitation of the applications of magnetic phenomena to many purposes for which electrical engineers would like to use them is the fact that the intensity of magnetic force is inversely proportional to the square of the distance from the magnetic pole and that no known method is available for concentrating a beam of magnetic intensity similar to the way, for example, in which a searchlight can be concentrated into a powerful and narrow beam, or to the beam effect obtainable with sound waves or electromagnetic waves. This limitation as regards magnetic force will account for the published statement that the magnetic mine is not effective if it is more than four or five fathoms deep. The suggestion that has appeared in some reports that a ship can magnetically draw to itself the body of the mine, belongs to the same realm of fantasy as the well-known Arabian Nights account of the ship which approached too near to a "magnetic mountain" and fell to pieces.

Germany Assists A.R.P.

WE are all for the preservation of a sense of proportion in wartime, but there seems to be something ridiculous in providing German lamps in British air-raid shelters. This, apparently, has happened at Macclesfield, where, to make the joke complete, a type of lamp labelled "Führer" brand has been used. It has been stated that these were the only lamps available at a suitable price, which seems incredible when one surveys the scope of the British lamp industry. No doubt pre-war stocks have to be liquidated, but in such a case we think that a little "camouflage" would have been a harmless deception to spare the residents' patriotic feelings. Or is this an unmoral suggestion?

Hull's Activities

MR. D. BELLAMY, the general manager of the Hull undertaking, is not sitting down and bemoaning the conditions created by the war. He has already recommended that no price increases shall be made during the current financial year, considering that it is undesirable to discourage industrial and domestic consumers from using electricity wisely and well. He has devised a useful heating arrangement for air-raid shelters which should help to keep up the sales, and he is continuing to use the local Press to maintain the Department's contact with the people of Hull. The latest advertisement stresses the great importance of sufficient and efficient lighting in the home, shop and factory, and offers the specialist advice and services of the Department free of charge. Some other undertakings might take a leaf out of Mr. Bellamy's book and refuse to bow down under adverse circumstances which it is in their power to mitigate.

Priority and Control

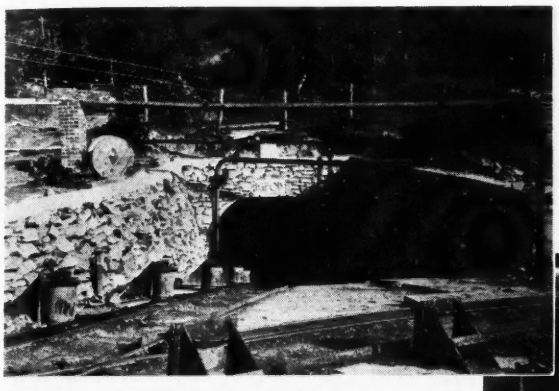
MANY manufacturers have slowed down work on some of their orders in the mistaken belief that their plans would be upset by the issue of priority certificates by the Ministry of Supply. Last week, however, the Parliamentary Secretary to the Ministry (Col. J. J. Llewellin) stated that not a single certificate had been issued, and it was not the intention to commence until there was a "clash" of requirements. The principal reason for refraining from issuing certificates was a fear that export orders might be delayed when export trade was of paramount importance. This is most laudable, but actually, of course, a considerable measure of control is exercised through the allocation of essential raw materials by the Controllers appointed by the Ministry. It is to be hoped that these Controllers will continue to give special consideraton to supplies of materials required for the execution of overseas orders, a matter of vital concern to the electrical industry in particular.

AN ELECTRIFIED COLLIERY

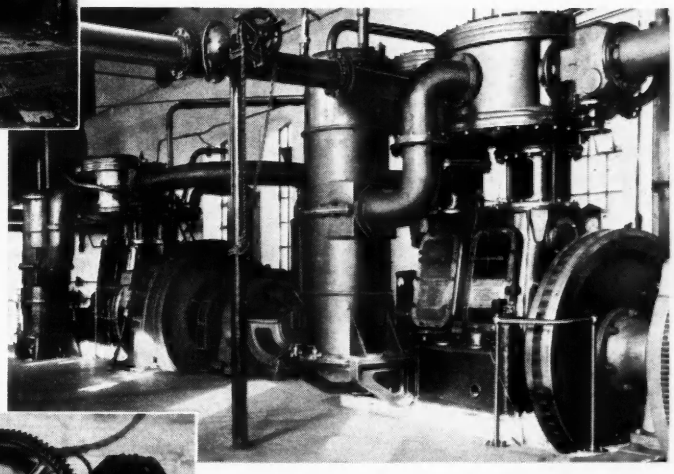
Monthly Consumption of 200,000 kWh

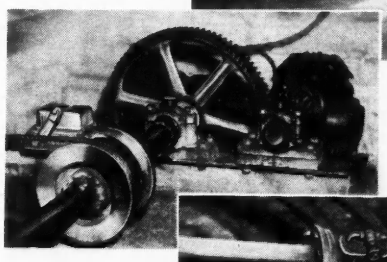
TWO things which impressed us above all others during a recent visit to the Wern Tarw Colliery of the South Wales Coalite Co., Ltd., were the short time in which the modernisation and electrification scheme, which is now nearly complete, has been carried out and the fact that private generation has been dispensed with entirely. We have been accustomed to look upon the electrification of a colliery as something like a ten-year job, but work on this scheme was started as recently as July, 1937. The colliery was partly electrified previously, but such plant as was installed covered only pumping in one seam and surface motors, and this was mostly obsolete and had to be replaced.

The consumption is about 200,000 kWh per month and the 70 motors total about 4,000 HP. The whole of the electrification and modernisation of the colliery has been carried out under the personal supervision of Mr. F. B. Kerridge, M.I.E.E., M.I.Min.E., colliery agent and a director of the company, to whom we are indebted for help in collecting the information given and the accompanying photographs. He is an enthusiast for public supply and believes that the generation of electricity is better left in the hands of those who can devote their whole attention to it.

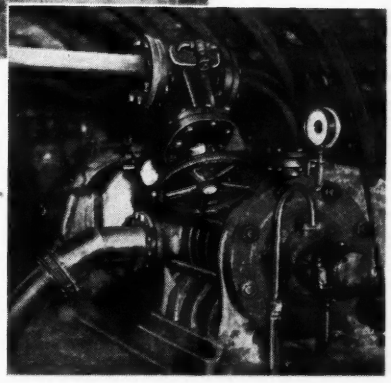


Entrance to Hafod Deep and (right) two converted compressors with 500-HP synchronous motors





Motor and worm gear unit operating Pentre landing, showing one of the limit switches



One of the main pumps at a drift heading

The acquisition of the colliery by the South Wales Coalite Co. and its modernisation are all part of a major scheme involving the erection of a large low-temperature carbonisation plant now complete, but in this article we are devoting our attention solely to the colliery electrification.

Four seams are worked at the colliery, of which two—the Pentre and Six Feet—are won from a pair of vertical shafts, and the remainder, *viz.*, the No. 3 Rhondda and Hafod, from inclines driven from the surface. The Pentre occurs at a depth of 90 yd. and the Six Feet at 230 yd. in the shafts, the former thereafter being worked to a distance of some 1,200 yd. to the dip at an average grade of approximately 9 in. per yd., while the latter is worked to a distance of 1,000 yd. also to the dip and reaches a maximum grade of no less than 30 in. per yd. The No. 3 Rhondda incline is over a mile in length to the face where the dip is now approximately 12 in. per yd. and the Hafod incline 800 yd. with a final dip of 9 in. per yd.

Main and subsidiary haulage is electrical except in the Six Feet where a steam main haulage, to be replaced later by electrical haulage, is used and, for special reasons, compressed air for subsidiary haulage. All seams except the Six Feet are machine cut and belt and jigger conveyors are used in the faces as well as in some cases in gate roads. In the Six Feet faces retarding conveyors are used and no coal cutters. Compressed air is used for coal cutting and conveying except in the case of one 400-yd. gate belt driven electrically.

One seam only, the No. 3 Rhondda, is troubled with water, the quantity made in the other seams being negligible, though pumping is also necessary in the Pentre and Hafod. Surface arrangements include screening, washing and coal breaking, which have been specially provided to ensure the high standard of quality required for preparation of "Coalite" at the low temperature carbonising works.

Originally the colliery depended for electricity on a 400-kW generator which was wholly inadequate and was taken out as soon as a connection with the South Wales Power Co.'s 33-kV main could be arranged. This, by the way, was provided in what must have been something like record time, ¾ mile of duplicate 33-kV overhead line being erected, temporary switching arrangements made and the supply commenced in three weeks. An outdoor sub-station has since been erected comprising one 1,500-kVA and two 625-kVA transformers, with provision for a second 1,500-kVA unit, stepping down to 3,300 V.

In view of the high-rupturing-capacity switchgear that would otherwise be required, reactors are installed on the 3,300-V side of each transformer and from there the supply is taken by buried cables to the colliery sub-

station nearby where the main 3,300-V switchboard is installed in a large building formerly used as a power house. This board consists of four iron-clad draw-out-type incoming and seven outgoing feeder switches. For the underground circuits leakage protection is provided to isolate any circuit in the event of any phase reaching 7½ per cent. out-of-balance.

At one end of the main board a special panel is installed for control of the maximum demand of the system. The power tariff is based on half-hourly m.d. in each month, and penalties and rebates operate below and above a certain load factor. Penalties and rebates are also operative for low and high p.f. as recorded during the period of maximum demand. It is thus obvious that it is of the greatest importance to keep the maximum demand under observation and control and it has been found that this can be done to a remarkable degree by controlling certain feeders, such as main underground pumps, which need not work continuously, and in fact it frequently pays to stop one of the large haulages for a minute or so at times of heavy load until the critical half-hour period has expired.

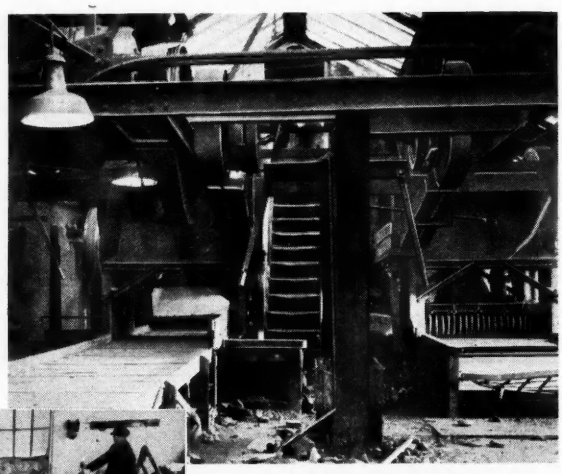
The panel for this purpose was specially designed by Metropolitan-Vickers to the company's requirements and consists essentially of a dial on which work red and black hands. The former is set to record independently and accumulatively whatever maximum demand it is desired to operate as a standard, and resets to zero at the end of each half-hour period, the commencement of each period being carefully synchronised with the power company's meters. The black hand records the actual cumulative demand of the system and also resets at the end of the period.

The object of the attendant is, of course, so to arrange the load that the black hand shall not be in advance of the red hand when the period ends, and in this he is assisted by signal lamps which show when the black hand lags behind or advances in front of the red hand by a predetermined amount. A further warning is also given by a Klaxon if the lead of the black hand becomes excessive, and another signal lamp shows if the power factor is below 0.84 when the black hand is leading.

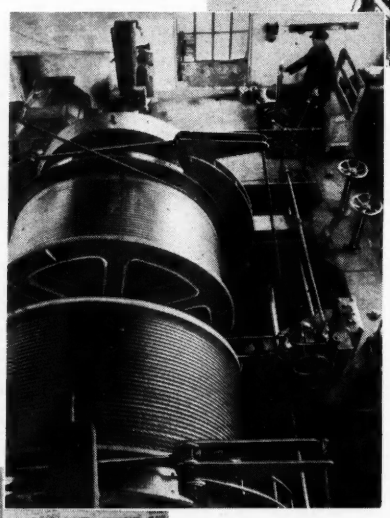
The panel works exceedingly well in practice, and it has been found possible by judicious control of the load to reduce the monthly maximum demand by some 30 per cent. without inconvenience or material delay to colliery operations. Power factor control of the system is provided by the two 500-HP compressor and 265-HP fan motors, later described, all of which are synchronous machines, and it is found that unity can be maintained without difficulty during the m.d. period with any two of the three motors running.

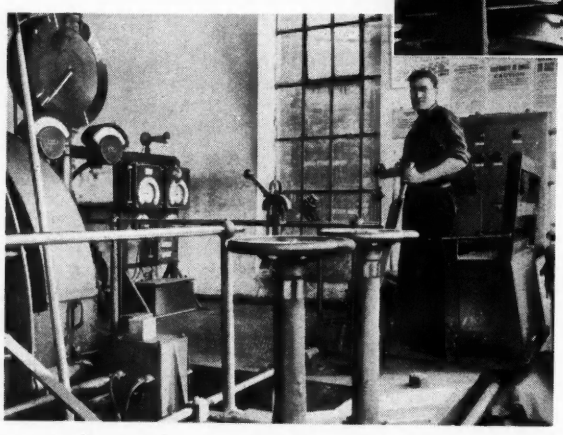
This load is carried without difficulty by one 1,500-kVA transformer, and the half-hour maximum demand is ordinarily kept within 700 kW. Momentary peaks of about 1,500 kW are experienced, however, and generating capacity of at least this amount with adequate standby capacity available would have been required had not public supply been adopted.

All underground feeders are 3,300 V, which is the voltage used for all the larger motors, "Transwitch" units being installed where necessary to step down to 550 V for smaller machines. The surface motor voltage is 440 to save changing a number of existing motors, and this is provided by means of one 150-kVA, 3,300/400-V transformer for general purposes and three similar units installed in the washery sub-station which is supplied by a separate feeder from the main 3,300-V board. Each of these transformers is wound for 550 V with a 440-V tapping, so that they could be used if necessary underground. A 440-V switchboard supplying three surface circuits is installed near the main 3,300-V board and made up of ironclad drawout type units. Lighting circuits are operated at 110 V from a 15-kVA 3,300/110-V transformer supplied from the main board and distributed by means of separate circuits controlled from an ironclad switchboard.



Above: Screening plant showing pick breaker (right) and picking belt (left); 25-HP motor in roof





Above: No. 1 shaft winder, with 250/500-HP motor. Left: Control platform of winder showing contactor panel

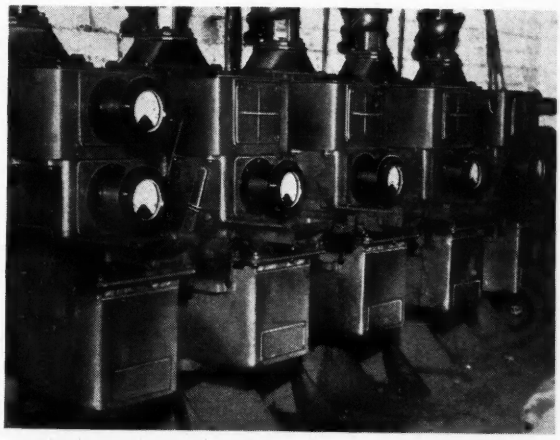
The washery sub-station is some 50 yd. from the main sub-station, and is equipped with three 150-kVA, 3,300/550/440-V transformers. These are controlled on the high-voltage side by ironclad draw-out type switches. On the low-voltage side is a switchboard made up of six ironclad draw-out type switches controlling the washery circuits.

In the power house and sub-station are installed two Belliss & Morcom 2,500-cu. ft. per min. reciprocating compressors driven by 500-HP, 3,300-V direct-coupled synchronous motors running at 273 RPM. One of these machines was originally steam driven. These compressors, together with a 5,000-cu. ft. steam-driven machine which they replace, deliver into a 30 ft. by 8 ft. receiver from which the underground system is served through a four-branch manifold supplying each of the four seams separately.

This arrangement permits separate metering of the air taken by each seam, which is done on a Kent meter panel equipped with integrating and recording air meters for each seam, a continuous pressure recorder, two water flow meters for the compressor cooling water, and a dial thermometer for taking the temperature of the latter. The air meters have been specially

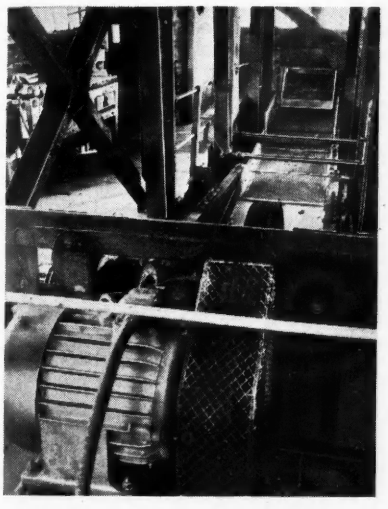
designed to show a red warning light when the air taken by any branch exceeds a predetermined quantity, and should this continue for a time interval which can be varied, a warning is given by a Klaxon horn. An audible warning is also given should the amount of cooling water circulating in either compressor fall below a predetermined amount. This metering arrangement has proved invaluable in detecting waste of compressed air and leakage which is such a common source of high power cost underground.

The winding engines are installed at each end of the same building, suitably partitioned. These were both originally steam operated, and while the engine serving the upcast shaft, which is used solely for ventilation, has been retained for emergency use, the coal shaft engine has been replaced by an electric winder. The latter was specially supplied for winding from two levels, viz., 90 yd. from the Pentre and 230 yd. from the Six Feet, and is fitted with two drums, one of which is loose and clutch operated, thus allowing the winding ropes to be adjusted at will for winding with both cages from either level.



Flameproof 3,300-V switchgear at Pentre landing

The drive is provided by a 3,000-V, 250-HP, 475-RPM motor served by a liquid starter with an automatic accelerating device, through single-reduction double helical gears. Lilley overwind and slow banking control is fitted and arranged to operate at each shaft level. The loose drum clutch is locked by a key device which is interlocked with a similar arrangement controlling a sliding landing used in the shaft when winding from the upper or Pentre level, the object being to ensure that the pit is unobstructed by the landing when winding from the lower or Six Feet level. The maximum capacity with the arrangement described, after allowing for changing from one level to the other, is 160 tons and 50 tons per hour from the Pentre and Six Feet seams, respectively.



Washery; clean coal (large) scrum driven by 20-HP motor

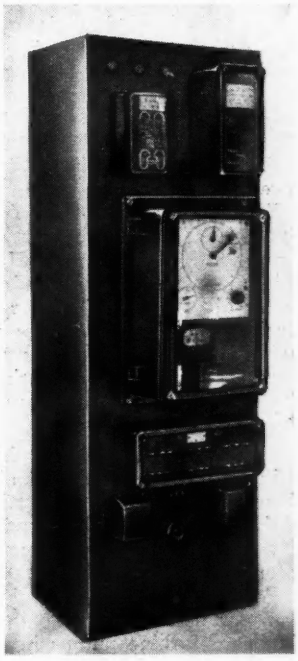
The power house building also contains the main mine fan. This was formerly driven by a direct coupled steam engine which has been retained for emergency use, while an alternative drive has been provided at the other end of the fan shaft by the installation of a 265-HP, 3,300-V, 720-RPM synchronous motor arranged for V-rope drive. To enable economy in energy consumption to be obtained at week-ends and to provide a margin for emergency a Sinclair variable-speed coupling is fitted which enables the fan speed to be varied between 150 and 230 RPM and the ventilation water gauge from 1½ to 3½ in., while the motor speed, of course, remains constant.

The screens comprise two rotary tram tipplers and shaker screens which deliver the larger coal on to picking belts over which are erected pick breakers. Coal is diverted as required to a main belt feeding a surge bunker from which the washery is supplied. The washery is a combined unit made up of a Fraser & Chalmers "Chance" sand flotation washery with a capacity of 55 tons per hour of 6 in. to ⅜ in. coal, which was installed prior to the acquisition of the colliery, and a Rheolaveur washery since added with a "Unifloc" slurry filter plant having a capacity of 45 tons per hour of ⅜ in. to 0 in. coal, the total washing capacity thus being 100 tons per hour of 6 in. to 0 in. coal.

The screens and washing electrical drives follow normal practice and call for no comment except that wherever necessary totally enclosed motors are used and the minimum possible number of types and sizes of motors have been standardised. Ironclad switchgear and armoured cable are used throughout. All motors where necessary are sequenced to ensure proper starting order and minimum inconvenience in the event of any motor tripping out on overload or in emergency. Stop-button switches are liberally provided at all necessary points, and arrangements have been made to prevent overflow of the washery coal surge-bunker by fitting a suitably protected mercury-switch which trips the motor driving the feeder belt should coal in the bunker reach a predetermined level.

Surface Transport

The surface traffic arrangements have been completely modernised by the installation of tram stocking sidings. After passing through the tipplers the empty trams are raised 14 ft. (to enable them to gravitate back to the pits) by an electrically operated automatic lift operated by a 10-HP, 440-V motor-driven worm gear with a centrifugal coupling and magnetic brake by means of which the ascending cage is stopped in the exact position to allow the tram, released by automatic scotches, to leave the cage without attention. The driving unit is a duplicate of that operating the shaft landing stage at the Pentre seam, so that one set of spares supplies both these essential drives.



M.d. control equipment

A Maclane automatic rubbish tipping installation has been provided for dealing with debris from underground, rubbish trams being tipped in the same way as coal trams, on to a 200-ft. conveyor belt feeding a 200-ton bunker. From this the rubbish is elevated and automatically tipped, to form a conical dump of increasing height, by a single drum haulage engine driven by a 50-HP, 440-V slip-ring motor with a tram-type controller, one man

operating the bunker discharge and haulage, which is capable of handling some 300 tons per shift, if required.

The lamproom houses a complete installation of 700 electric lamps consisting of 350 Oldham hand-lamps and 350 Oldham Wheat cap-lamps. For the former a 440-V, AC 110-V, DC motor-generator is provided, and for the latter duplicate 440-V AC, 5.2-V DC motor generators. The Oldham Wheat installation is of special interest, these lamps being so designed as to obviate the necessity for dissembling for charging, the workmen placing the accumulator case in its numbered place on a shelf and the lamp itself on a specially shaped bracket where contact is made with the two small terminals on the lamp casing and charging is immediately commenced. The rate of charging is shown by a small meter above each lamp, and the charging contacts on the lamp case are thermostatically disconnected as soon as the lamp is removed from its bracket, thus avoiding any risk of a spark being produced in service.

Haulage Systems

On the surface of the No. 3 Rhondda incline a belt-driven fan has been replaced by a propeller type unit direct coupled to a 35-HP, 3,300-V, 960-RPM motor, the capacity of the fan being 50,000 cu. ft. per min. of air at 2 in. water gauge. Haulage from the No. 3 Rhondda incline was formerly by steam engine which has now been replaced by a double-drum, double-geared haulage driven by a 350-HP, 3,300-V, 720-RPM motor with a liquid controller. The haulage speed is 6 MPH, and the load raised is 20 trams each containing approximately one ton of coal.

The length of haul is 2,000 yd. A short length at the surface end of the haulage road is flat and the second drum is used for a tail rope on this and to lower the journey to the screens from the mouth of the incline. The empty journey is lowered with the main drum clutch disengaged to save time at a speed of 9 to 10 MPH, and the dissipation of heat generated on to the brake paths has caused some difficulty which has been overcome by fitting copper mesh radiating rings. Workmen are raised and lowered by the haulage on "spakes" or carriages, five of which, each accommodating twelve men, form a journey.

The main drum clutch is kept engaged when lowering men or heavy journeys of material, and regenerative braking is adopted by putting the controller hard over when, of course, the speed of the engine is limited by the rated speed of the motor. A speed indicator is fitted to enable the driver to keep the haulage speed within the statutory limit of 3 MPH when raising or lowering men.

For auxiliary haulage below ground, Sheepbridge single- and double-drum portable haulages driven by flame-proof enclosed 16/25-HP, 550-V motors through epicyclic gears have been adopted as standard. The motors have squirrel-cage rotors, and are switched straight on the line by flameproof air-break reversing switches, no starters being required as the motor is normally kept running and the load started by slipping the clutch on the epicyclic gear.

Pumping Methods

Pumping in the No. 3 seam is a matter of head rather than quantity, the total vertical depth to the bottom of the incline being approximately 1,500 ft. The quantity of water usually averages about 150 GPM, but intermittent rushes up to 400 GPM occasionally occur.

Formerly, pumping was done in five stages, which has now been reduced to two by the installation of duplicate turbine pumps in pairs, mid-way and near the bottom of the incline. The pumps, which are by Mather & Platt, each have a capacity of 400 GPM, against a head of 800 ft., and are driven by 140-HP, 1,500-RPM, 3,300-V squirrel-cage motors. Direct-on starting is adopted and flameproof control switches are installed. The pumps are so arranged that they can all be worked simultaneously if desired, but ordinarily one at each stage works only for about 20 min. in each hour.

Auxiliary pumping is by Mather & Platt 200-GPM, 250-ft. head, and 100-GPM, 150-ft. head turbines, and small 10-HP reciprocating Joseph Evans geared pumps installed where necessary, there being only four standard types of pump in use. All motors on these pumps are of totally-enclosed flameproof design for 550 V, and supplied through portable 75-kVA combined 3,300/550-V switch and transformer units which also supply the auxiliary haulages already mentioned. Flameproof gate-end unit switches with leakage protection are used throughout the 550-V distribution system, and paper insulated, lead sheathed double wire armoured cable.

In the Pentre seam a 350-HP main haulage is installed exactly similar to the No. 3 Rhondda incline engine already described, except that one drum only is fitted. Auxiliary haulage is by Sheepbridge units as in the No. 3 Rhondda, and in addition one 24-in. electrically driven gate belt is used for a double-unit face. A 250-GPM, 400-ft. head Mather & Platt pump driven by a 45-HP, 3,300-V motor with direct-on starting is installed in a pumproom near the shaft, and fed by auxiliary pumps as in the No. 3 Rhondda seam. A 3,300-V ironclad unit switchboard is installed in the pumproom with outgoing feeders, all with leakage protection, to the main haulage, pumps, a lighting transformer and a "Transwitch" from which the 550-V circuits are distributed through gate-end switch units.

In the Hafod seam the main haulage to the surface is by a double-drum double-geared engine driven by a 150-HP, 3,300-V, 720-RPM motor with a liquid controller, this engine replacing a compressed air haulage formerly used. Below ground a 3,300/550-V "Transwitch" unit is installed for supplying Sheepbridge auxiliary haulages and an 8-HP Evans pump through gate-end switches. In the Six Feet seam a 350-HP haulage exactly similar to that installed in the Pentre is being erected near the pit bottom to replace the existing steam haulage worked from the surface.

The main contractors for the scheme were the Metropolitan-Vickers Electrical Co., Ltd., whose motors, transformers and switchgear are exclusively installed with the exception of a few small machines, and the 33,000-V main switchgear which was made by the English Electric Co., Ltd. The mechanical parts of the winder and main haulages were produced by the Uskside Engineering Co.

Railways in Air Raids

AN interesting study of the question of protecting electrified railway lines from aerial bombardment has been published by the bulletin of the Italian Society for the Advancement of Science, over the signature of Dean Guido Corbellini, of Bologna University. Dean Corbellini points out that damage may be caused to the track, the trolley system, or the sub-stations. Damage to the generating plants is a fourth possibility, but this rarely affects the railways alone. Damage to trolley systems, he believes, is not of a serious character. "The aerial feeding system supplying current to trains is much simpler than the systems of control and of signals, and its repair, in case of damage, can easily be carried out at the same time as the repair of the tracks and signals. Therefore, on a line carrying equal traffic complete restoration on an electrified line will require no longer time than that on a line using steam traction. The problem involved is merely one of providing suitable supplies of standardised electrical material and a sufficient corps of electricians and repair men."

Destruction of a sub-station is a problem of another order, the solution of which, Dean Corbellini feels, is even simpler. "Where an aerial attack has seriously damaged or completely destroyed a sub-station, service can rapidly be resumed by cutting out the damaged sub-station and replacing it with one or more mobile sub-stations, kept in reserve for the purpose." These could easily be installed on flat wagons, ready assembled and requiring only to be connected by temporary leads to the source of energy and to the distribution line providing power to the trolley system. One or two such mobile stations could be hauled to a convenient siding near the damaged sub-station and within a few hours the normal service conditions could be restored.

QUARRY REGULATIONS

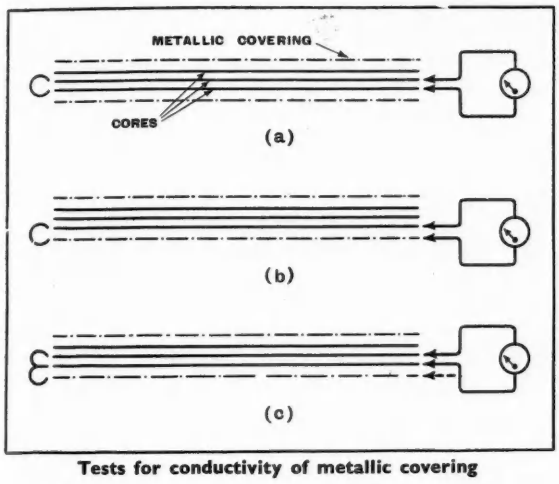
More Stringent Requirements

By C. H. Smith

THE latest regulations governing the use of electricity in quarries are considerably more stringent in several respects than any previous ones. They are of interest both to quarry owners and to any electrical engineers who may be called upon to examine and certify quarry plant. Until last year quarries of 20 ft. depth or less, came under the jurisdiction of the Home Office, and those of greater depth under the Mines Department. Now, they all come under the Mines Department, irrespective of depth, and are governed by the Quarries General Regulations (Electricity), 1938, issued under Statutory Rules and Orders No. 1233 of 1938.

Cables

The most important requirements may be summarised first in relation to cables. A continuous metallic covering is specified for all conductors (except flexible cables) when the voltage exceeds 125 AC or 250 DC. This covering will usually be in the form either of screwed conduit or steel armouring and must have a conductivity of not less than 50 per cent. of that of the largest live conductor it encloses. The conductivity is to be measured at intervals not exceeding six months, and the results recorded in a log book kept at the quarry.



Tests for conductivity of metallic covering

An easy way of carrying out this test is to join solidly two live conductors at one end of the cable, and measure their resistance from the other end with some form of ohmmeter reading about 0-20 ohms. It should be capable of passing several amperes through the cable to ensure reliable readings. Since the two line conductors chosen will usually be of the same cross-sectional area, half the measured value will be the resistance of one core (see (a) in the accompanying figure). One core may next be joined solidly to the metallic covering, and the test repeated (see (b)). Deducting the known resistance of one core, leaves the resistance of the covering.

Typical Example

To take a numerical example: Assume that the two cores in series have a resistance of 1.6 ohms, and the core and covering in series a resistance of 2.2 ohms, then

Resistance of two cores in series ... ... =1.6 ohm
,, ,, one core ... ... =0.8 ,,
,, ,, one core and covering ... =2.2 ,,
,, ,, covering only=2.2−0.8 ... =1.4 ,,

$$\text{Conductivity} = \frac{0.8}{1.4} \times 100 = 57.1 \text{ per cent.}$$

which is satisfactory.

Some time walking between the two ends of the cable may be saved by joining two cores and the metallic covering together in the first instance, and then testing between the appropriate pairs from the other end (see (c)). Obviously power must be switched off before the tests are made, and everything securely reconnected afterwards. On a three-phase system the third core may be ignored for the purpose of these tests, and the resistance of each core will be similar.

If armoured cables are used, they must be wire armoured. Steel tape armouring is not permitted. The conductance of the lead sheath may be included in the total conductance of the metallic covering, provided that the joints are plumbed. Flexible metallic tubing may be employed between the end of solid conduit and a motor terminal box to permit small adjustments of the motors, but must be supplemented by an earth wire of not less than 7/16 SWG.

Flexible cables must be multi-core, and contain an earth conductor not less in size than the largest live conductor. If the voltage exceeds 125 AC or 250 DC but does not exceed 650-V AC or DC there must in addition be a metallic covering or flexible metallic screens. Above 650 V metallic screens are not accepted and complete metallic covering is called for, plus the earth conductor. The metallic covering must have a conductivity of at least 50 per cent. of that of the largest live conductor, except that with very large cables it need not exceed the equivalent of a 7/16 SWG copper conductor. Metallic screens must have a conductance at least equivalent to that of a 7/16 SWG copper conductor. When the size of a multi-core cable would render it impracticable, single core cables may be used instead, but they must have the special approval of the Board of Trade. All cables, whether fixed or flexible, must be securely anchored at each end, and the insulation sealed to exclude moisture, etc.

Earthing

Above 125 V AC or 250 V DC metallic structures must be earthed (unless they are so situated that they cannot be touched) by a conductor not less than 7/16 SWG in size. The metallic coverings referred to under "cables" may be used for this purpose. In the case of flexible cables a smaller size is permissible, provided it complies with the requirements of the previous section. This regulation does not apply to overhead lines.

One pole of the system must be earthed in the following cases (i) a three-phase AC system exceeding 25 V, the neutral point; (ii) an earthed concentric system, the outer conductor; (iii) a traction system, the pole connected to the running rails. If the resistance of the earth between the system earth plate, and the earth plate for the metallic structures exceeds 2 ohms, they must be joined by an earthing conductor.

The resistance between the various earth plates should be measured with a substantial current, and in both directions, as it is often found to vary considerably according to the direction of the current flow. No fuse or automatic circuit-breaker is allowed in the earth conductor, though a test link may be fitted. A current limiting device is also allowable.

Leakage current may not exceed one ten-thousandth part of the rated current of the circuit. Expressed in the more familiar megohms, this means that the insulation resistance must not fall below

$$\frac{\text{voltage of circuit}}{\text{rated current} \times 100} = \text{megohms.}$$

The insulation resistance tests are to be recorded in the log book at intervals not exceeding six months. In the case of portable or transportable apparatus working at voltages exceeding 650 AC a leakage trip is required, to operate at 15 per cent. of the rated current, or 5 A, whichever is the greater. DC plant is not affected by this last requirement.

Portable Apparatus

Portable apparatus of 4 HP and under (with other energy consuming devices of 4 kVA or less) is not to be supplied at voltages exceeding 110 AC or 250 DC. This regulation is aimed at gear which can be held in the hand, and for this reason auxiliary apparatus permanently attached to larger portable gear, such as a brake magnet coil on a motor, is exempt from the regulations, if the larger gear is exempt also on account of size. In the case of a three-phase supply the voltage of the system is deemed to be the voltage between the outers and, further, the neutral point of the system must be earthed (see "Earthing"). This gives 64 V between line and earth.

Portable hand lamps may not be used on pressures exceeding 250 V DC or on AC at 64 V *from earth*. The sense of this is apparent from the last paragraph. When the low-voltage supply is obtained through a transformer, the latter must be double wound, to keep the low-voltage system quite distinct.

General Scope

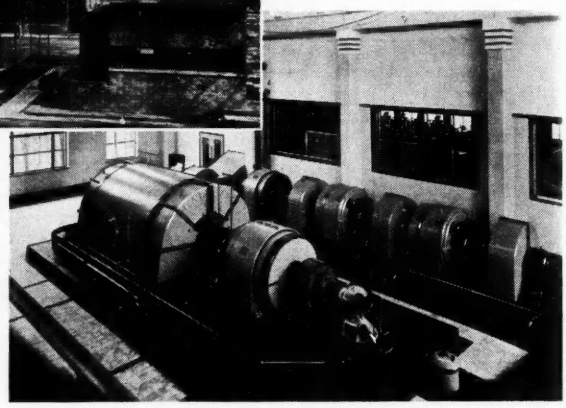
Overhead lines must comply with the Electricity Commissioners' regulations, and outdoor sub-stations and switch stations must be protected by a fence at least 8 ft. high, unless

(*Concluded at foot of next page.*)

DUTCH TESTING LABORATORY

High-voltage Investigations

AN electrical testing laboratory has recently been completed on the outskirts of Arnhem, Holland, by the Kema Association, a body which was formed some years ago under the joint auspices of the principal electricity supply undertakings in the Netherlands. In the new establishment it is possible to test generators, transformers and other distribution equipment as well as smaller apparatus, lamps and electricity meters. The main buildings include a machine house for the short-circuiting laboratory, a high-voltage laboratory, a general laboratory, a control building and one for lectures and demonstrations. Around the short-circuiting laboratory the other buildings are grouped in two concentric half circles, so arranged that laboratories which might give rise to mutual interference are as far apart as possible. Power is drawn from the Arnhem municipal electricity supply mains at 10 kV and stepped down by transformers having a total capacity of 3,200 kVA which have been installed in the high-voltage, general and short-circuit laboratories.



View of laboratory and (below) Parsons synchronous three-phase generator driven by a 1,000-HP asynchronous motor

The various buildings are provided with electrically heated ceilings and floors. Immediately underneath the floor and above the ceiling ⅛ in. steel pipes are cemented into the concrete, and through these are drawn lead-covered cables each containing two resistance conductors insulated with a substance named "Ozuriet," a rubber-like material that can continuously withstand a temperature of 120 deg. C. The electric heating is principally effected during the night hours; only on very cold days has it been found necessary to switch on the heating during the luncheon hour.

3,000,000-V Generator

In the high-voltage laboratory there are three 200-kVA single-phase transformers capable of furnishing three-phase at 175 or 500 kV, according to the way they are connected up, or as single-phase at 525 kV. There is also an impulse generator operating at 3,000,000 V.

The general laboratory, of three storeys and a basement, is intended for investigations at up to 100 kV with up to 20,000 A. The instrument calibration department is provided with a 400-V battery, a DC source of up to 400 A and a three-phase double generator which is designed for variable voltages and frequencies.

The high-frequency department is equipped with a set generating at 500 cycles. The high-voltage section has several 20-kV and one 100-kV transformers, while there are an impulse generator and a Tesla transformer, both for up to 300 kV. The heavy-current department is adapted for tests up to 34,000 A, and for this purpose has a 170-kVA transformer rated for thirty minutes.

In the short-circuiting laboratory is a synchronous three-phase generator of 40,000 kVA which, according to the definitions of the International Electro-technical Commission, can provide a three-phase symmetrical breaking capacity of 660,000 kVA. The generator is driven by a 1,000-HP asynchronous motor coupled direct to the rotor, which can run up to about 2,950 RPM and has two sets of windings per phase, so that its full output is available at either 11 kV, 6.5 kV, 5.5 kV or 3.2 kV.

In addition, there are a super exciter set, comprising two DC, 800-V generators each capable of delivering 8,500 A; a 500 HP driving motor and three flywheels; and an auxiliary exciter set for 100 V and 500 A, which is only used for direct excitation of the short-circuit generator in the case of tests of limited capacity. For tests exceeding about 100,000 kVA the super exciter set is used, as well as for DC short-circuit tests with 17,000 A at up to 800 V, and 8,500 A at between 800 and 1,600 V.

There are also three single-phase transformers for short-circuit tests at voltage exceeding 11 kV. Each transformer has four secondary sets of windings, each for 12,500 V, which can be connected in series, in parallel, or in series-parallel; the secondaries can also be connected in star and delta for up to about 100 kV three-phase and 165 kV single-phase.

The largest building is the high-voltage laboratory which is 160 ft. in length, 55 ft. wide and 45 ft. high. The impulse generator comprises 72 condensers, each of 0.54 microfarad at 45 kV; hence the total output for continuous operation is 35,000 W per sec. For single "shots" the condensers may be somewhat overloaded to 45,000 W per sec. and in series the nominal impulse voltage amounts to 3,000,000 V, while by parallel connection impulse currents up to about 300,000 A can be generated.

Overhead Line Testing

When building the high-voltage laboratory the possibility was visualised that it might at some future date be linked up to the 150-kV overhead transmission line connecting the towns of Nymegen and Apeldoorn, thus offering opportunities for testing fully-equipped normal overhead lines. For this reason the roof of the northern wing was specially reinforced, with space for the installation of klydonographs, condensers for high-frequency telephony and remote control. Below the central control room of the laboratory are special rooms in which examples of unfavourable atmospheric conditions such as fog, soot, smoke, dust, &c., can be reproduced. Outside there is a vibration test stand.

In the instruction and demonstration building for domestic electrical apparatus, lectures and lessons on electric cooking, washing, ironing, &c., are regularly given to teachers of domestic science.

The laboratory is under the direction of Prof. J. C. Van Staveren.

Quarry Regulations (*Concluded from preceding page*)

all apparatus and conductors are completely enclosed in earthed metal casings. All apparatus, conductors, etc., must comply with any relevant British Standard Specifications and there is also the usual general regulation that all gear shall be adequate in size and properly installed, which covers anything omitted from the specific regulations.

It is the duty of the owner to enforce the regulations, and of all workmen, contractors, and others to obey them. Only a skilled electrician may carry out electrical work. A "shock card" must be hung at the quarry and log books are to be kept for at least twelve months after the date of the last entry.

Cables or apparatus in use on July 1st, 1938, which at that date complied with existing regulations (*e.g.*, steel tape armoured cables) need not be brought up to the new standard of construction before July 1st, 1945. But if alterations or additions are made these must comply forthwith, and the same requirement applies to any plant installed after July 1st, 1938. Telephones and signalling systems energised by a battery, not exceeding 50 V, or telephones worked by hand magnetos are exempt. The regulations relating to conductivity, earthing, leakage current, portable apparatus and general apply forthwith.

CIRCUIT-BREAKER TESTING

How it has Developed

By E. E. I. Pilcher, B.A., B.Sc., and I. M. L. Ward, B.Sc.

IN the years before 1914, when the capacity of generating stations was small, circuit-breakers, or oil-switches as they were then called, were rated almost entirely on the basis of their normal current-carrying capacity and on the voltage at which they were intended to operate. In fact, for some time it was thought that any automatic oil-switch could break any short-circuit which could occur. The conception of a rating in terms of the short-circuit current which could be successfully interrupted dates only from about 1910, and figures of breaking capacity estimated at that time were often disastrously wide of the mark.

The first actual tests to be made in this country were carried out by the City of Birmingham Electric Supply Department, about the year 1911. In the same year tests were made in the United States at Fisk Street, Chicago, when the American General Electric Co. introduced the magnetic oscillograph as a means of recording what actually happened during each attempt at interruption. As a result, certain improvements in design were effected, but, in the absence of any true knowledge of the theory of arc interruption, little real progress was made.

At the close of the last war, in 1919, the Electrical Research Association set up a committee to investigate the whole question of circuit-breaker operation. The first two years of the investigation which followed was spent in collecting facts and, at the end of that time, the committee propounded numerous questions to which, in their opinion, answers would have to be found before further progress could be made. The means for obtaining answers to these questions were meagre, since the supply authorities were naturally averse to short-circuiting their systems and generating plants for tests on circuit-breakers. Various investigators had made partial attacks on the problem from a scientific standpoint, the most notable being that of Bauer as early as 1913-1915, but lack of suitable equipment, and of large machines on which theories could be checked, prevented these attempts from being of real value. During the decade which followed the war, the two main difficulties which barred the road to progress were the absence of adequate test plant and the lack of any true theoretical foundation on which to base design.

Meanwhile, those manufacturers who were producers both of large generators and of switchgear were able occasionally to take advantage of their position by testing their circuit-breakers whenever a suitable generator was undergoing its performance tests. Most of the breaking-capacity tests in this country which were made shortly after the war were carried out under these circumstances. In America, during 1921, the Baltimore Electric Power Co. put its system at the disposal of the Westinghouse and the General Electric Companies for circuit-breaker testing and there followed the now-famous "Baltimore tests."

The Original B.S.S.

The first British Standard Specification, No. 116, dealing with the operation and testing of circuit-breakers, appeared in the year 1923, and introduced the test cycle "B-2'-B" denoting a series of two breaking-operations separated by an interval of two minutes. At that time the importance of a breaker having sufficient strength to withstand the electromagnetic forces produced by the "making-current" had not been generally accepted. This specification was revised in 1929 and the "making" tests were introduced. Two test cycles were required to prove compliance with the provisions of the revised specification, *viz.*, "B-2'-MB" and "M-2'-M." The main weaknesses of these two editions of B.S.S. 116 lay, first, in the omission of provisions now known to be essential if tests are to reproduce the most arduous conditions which may be encountered in service, and secondly, in the statement that the recovery voltage should be measured "in the usual manner." There were, in fact, widely differing methods then being employed for measuring recovery voltage, which led to substantially different estimates of the kVA interrupted.

During the period 1919-1929, therefore, it may be said that the progress in the testing of circuit-breakers was relatively small. As generating plant grew in capacity, and as distribution systems were rapidly being interconnected, the need for further and more speedy progress became increasingly evident, and it was obvious that this could only be realised if adequate testing stations were built.

In Germany the A.E.G. had first started testing circuit-breakers in 1912 with plant having a capacity of about 300 MVA. The first American testing station was built by the G.E. Company at Schenectady in 1920, and at that time this station also had a capacity of about 300 MVA. In this country the first two stations were completed in 1930 and 1934, and at the present time we have four large stations each of which is capable of carrying out tests up to 1,500 MVA. All have oscillographic equipment capable of making a record of the dozen or more different phenomena, simultaneously, during the interruption of a short-circuit current.

Recent Progress

During the last ten years the desired progress in circuit-breaker design has been largely realised. In the main, this has been due to the testing facilities now available; but closely following the erection of testing stations, theories of arc interruption were formulated and checked, so that theory and experiment have advanced hand in hand, each lending an impetus to the other. The progress made during the years immediately succeeding 1929 quickly made it evident that a further revision of B.S.S. 116 was needed. The engineers of the British testing stations had been associated on a committee of test station owners, and in 1934 were in a position to formulate definite proposals which the British National Committee subsequently put before the International Electrotechnical Commission. So complete were these, that they were at once adopted as a basis for discussion, and led eventually to I.E.C. Publication No. 56, and to the 1937 revision of B.S.S. 116.

A comparison between the provisions of the 1929 and 1937 revisions of the B.S. Specification provides a good illustration of the progress which has been made during this period of rapid development. In the light of present-day knowledge it is difficult, if not impossible, to state just what series of tests may be taken as proving compliance with the requirements of the older specification; so many vitally important factors were left unregulated that, without supplementary provisions, the type-tests specified were, in fact, of very small value as they stood. Thus, it would be quite possible to arrange tests which complied literally with the provisions of the 1929 specification, in such a way that a very poor breaker would show satisfactory performance. The same breaker subjected to 1937 specification tests would fail ignominiously and consistently.

Rating Certificates

Although technically B.S.S. 116/1937 provides a satisfactory basis for circuit-breaker rating and proving—a basis, moreover, which incorporates all the internationally agreed recommendations without modification—there remains the practical difficulty that many supply engineers do not understand the fundamentals of circuit-breaker design sufficiently to assess the value of test results. They cannot be sure whether a given test report does, or does not, demonstrate compliance with the standard requirements.

To overcome this, the leading short-circuit testing stations in this country determined to convert their committee into a regularly incorporated body, which alone would issue standard certificates of rating in respect of tests made by any of them. This Association of Short-circuit Testing Authorities was incorporated last December, and is now commencing to issue test certificates, although it will naturally be some time before all the sizes of breaker built have been type-tested and certified. In co-operation with the D.S.I.R. (National Physical Laboratory) arrangements have been made so that all British makers of switchgear can have their more commonly used sizes of breaker tested in A.S.T.A. stations, and satisfactory results certified either by the N.P.L. or by the A.S.T.A., on exactly the same lines as apply to the owners of the test stations.

Marine Engineers' Examinations

AN examination for admission to associate membership of the Institute of Marine Engineers is to be held from May 20th to 27th, 1940. The annual examination for admission of probationer students and students will be held from May 20th to 28th. The Institute's examinations are held in London and other centres according to candidates' places of residence. Full particulars of the syllabus and exemptions allowable may be obtained on application to the Secretary of the Institute, 73, Amersham Road, High Wycombe, Bucks.

TROLLEY-BUS SUPPLY

Case for the Three-wire System

By T. Kearns, A.M.I.E.E.

IT is being realised increasingly that the trolley-bus has its own peculiar requirements that are not always fulfilled by modifications in the tramway practice out of which it has developed. This is particularly so in regard to overhead work, but there appears to have been no deviation from the two-wire DC system of supply. A comparison of the electrical characteristics of tramway and trolley-bus networks shows a big difference in the resistance of the negative

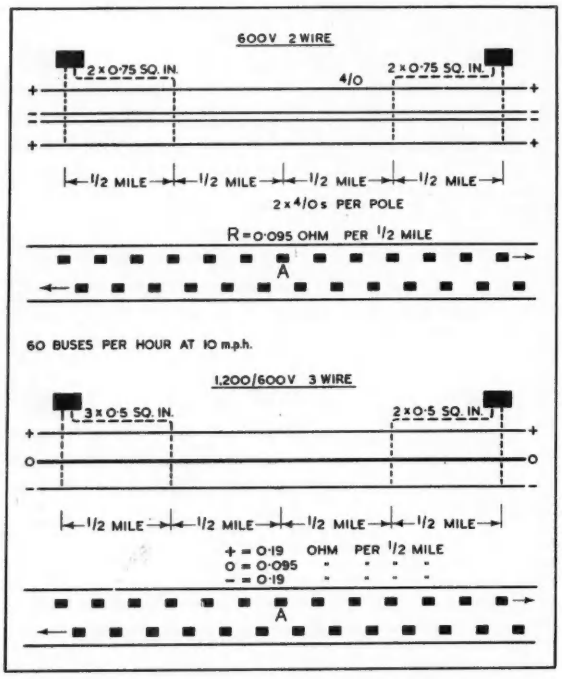


Fig. 1.—Standard two-wire layout and three-wire equivalent

return, the four track rails having a resistance of some 0.007 ohm per half mile against 0.095 ohm of the trolley-bus overhead wires. This suggests the desirability of considering the adoption of a three-wire system. There appears to be no such system in operation in this country, presumably because the Orders for trolley-bus operation made by the Minister of Transport limit the voltage between overhead conductors to 600 V with 650 V at the sub-stations, the latter being the limit imposed by the Tramway Regulations.

The Ministry has proved to be amenable in modifying regulations to suit trolley-bus requirements and as this regulation was probably drafted to limit the maximum voltage to earth, which would still be the same for a three-wire supply, there is no reason to presume that the attitude would be any other in this particular instance if detailed investigation indicated a modification as justifiable.

Reduced Voltage Drop

This suggestion is made from the supply engineer's viewpoint, as greatly reducing voltage drop, and it would be interesting to obtain traction engineers' views as to whether there is any legitimate objection to its adoption. The voltage drop question is most acute in instances where tramways are being changed over to trolley-bus operation, and where every effort is being made to utilise existing feeders, either ex-lighting or traction. In some cases this will be found impracticable and new sub-stations and feeders will have to be laid down, because trolley-buses, with their more severe demands and overhead negative, cause a much larger return voltage drop than tramways. In the latter case the drop is limited by regulations to 7 V between any two points in order to minimise electrolysis, but it also gives a working upper limit of voltage drop on tramway uninsulated returns.

The employment of a three-wire network might very well render unnecessary additional outlay on new sub-stations, as it would normally reduce the voltage drop on peak load by about 50 per cent. with a good balance. Fig. 1 illustrates diagrammatically a standard layout of half-mile sections of 4/0's with sub-stations two miles apart. In the two-wire case the feeders are 2×0.75 sq. in. against 3×0.5 sq. in. for three-wire equivalent copper section.

The average current per bus is taken as 50 A for a flat area from practical observations. Both positives and negatives in the two-wire case, and mid-wires in the three-wire example, are presumed to be tied together at frequent intervals. With sixty buses per hour at 10 MPH the voltage drop to Bus A, midway between the two sub-stations is, by calculation, 48.2 in the first case and 22.2 in the second and the losses are 16 kW and 7 kW. Traffic congestion may increase the calculated maximum drop threefold, but if the hold-up is on both up (positive) and down (negative) lines, the three-wire system would show up to its best advantage.

Possible Savings

Fig. 2 shows a typical load curve for a system with a base service of twelve buses per hour, with sixty per hour at peak times (actually noted). The load factor of losses of such a curve will be found to be about 15 per cent. and the kWh lost in DC transmission per mile per annum (six-day week) for a two-wire system $= 7{,}488$ (hr.) $\times 16 \times \frac{15}{100} = 18{,}000$ at, say, 0.5d. per kWh $= £38$, against $\frac{7}{16} \times 38 = £17$ in the three-wire case. These losses are borne by the transport authority and represent a saving of £21 per mile per annum for the system and service considered above. Assuming mid-wire losses to be negligible, these savings would be in addition to the advantage of improved voltage regulation.

The saving to the supply authority would be on maximum demand charges only for generation, transmission, and local sub-station plant. Thus, assuming a diversity of 2 between the traction load and generation peak, and 20 per cent. loss in transmission, &c., these would be $\frac{16-7}{22} \times \frac{120}{100} = 2.7$ kW at, say, £2.7 per kW for generation together with $16-7=9$ kW at, say, £1.2 per kW at DC bars for rectifier, sub-station and transmission back to generating station.

This saving of £18 per mile per annum capitalised for a twenty-year period at 7.5 per cent. sinking fund and interest charges amounts to £240 per mile of the above system, and is offset in the case of separate authorities by loss of revenue due to reduction in DC losses, the profit on which, however, cannot be very much at a charge of 0.5d. per kWh.

The additional capital expenditure for a three-wire supply should not be great for new systems, as there is very little difference in cost between 1,200/600-V three-wire and 600-V two-wire glass-bulb rectifiers of the same output in the larger units. The number of feeder circuits per sub-station would be doubled, but of half previous rating. The underground feeders could be of equivalent copper section, but rated at a

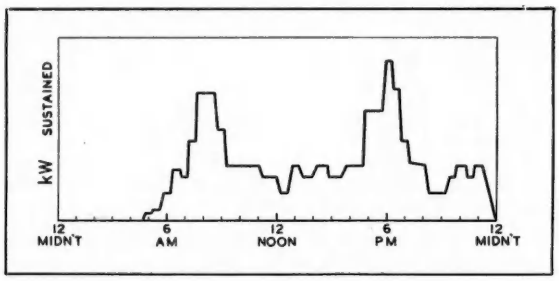


Fig. 2.—Typical load curve

higher voltage, as would also the insulation of the overhead circuit at cross-overs.

The cost of changing over existing two-wire systems would depend to a great extent on individual layouts. For example, rectifier plant consisting of a twelve-phase transformer with two six-phase bulbs could generally be arranged for three-wire supply at little additional cost. The number of feeder circuits is doubled as before, and it is unlikely that the underground feeders would be rated for 1,200 V. Unless, therefore, there is a spare cable available—the employment of disused

(Concluded at foot of next page).

INSTITUTION PROCEEDINGS

Papers and Addresses

Insulating Fluids

FLUIDS for the insulation of electrical apparatus by immersion are discussed in a paper by Mr. F. Meyer (General Electric Co., Ltd.) which has been issued by the Institution of Electrical Engineers. It is divided into three sections, the first being concerned with transformer and switch oils, some of which are now so highly refined that they can be used medicinally. Such refinement is not believed to be either necessary or desirable, since a low sludge value is of small importance, for switchgear purposes and is not, alone, the criterion of a good transformer oil without regard to other properties and service conditions. A high degree of refinement minimises sludging, but introduces the risk of acid formation with age, which is equally menacing. The author therefore suggests that present practice will tend to be discarded in favour of a more moderate degree of refinement.

An experimental investigation has suggested that with Grade A oils (practically zero sludge value) there is a definite acceleration of acid formation during the third month and even after six months there is no evident tendency for this rate to decrease; in fact, the average at six months seems to be an increasing rate. With Grade B oils (nowadays readily procurable with a sludge value of 0.3 or less) the rate of acidity increase is fairly uniform over six months with a definite indication of decrease after approximately five months. Grade A oils in which varnished coils are immersed develop slightly more acid than corresponding oils containing unvarnished coils, although the latter seem to produce more volatile acidity, revealed by the presence of acetic acid. Similar results are obtainable with Grade B oils, but with hardly any indication of volatility. The difference between the two classes is very marked, the worst measured "B" acidity being small compared with "A" results.

The author contends that his own tests and the sum total of the experience of transformer oil users make a strong case for the adoption of an oil of the lowest acidity development, even at the expense of the low sludge values now obtained. But how is acidity development to be measured? It is suggested that the Michie sludge test (B.S.S. 148-1933) should be extended to the determination of acidity in the following manner. Filter off the sludge and make up the filtrate by the addition of petroleum ether to 500 cm.^{3}. Take 200 cm.^{3} of this, add 100 cm.^{3} of neutral alcohol with 2 cm.^{3} of alkali blue indicator and allow to stand for 24 hours; then titrate with N/10 KOH (one-tenth normal solution of potassium hydroxide). It is considered feasible by this method to fix the maximum developed acidity at 1.5 milligrammes KOH per gramme of oil. Present original acid values approximating to 0.05 milligramme have in some cases increased to 4 or 5 milligrammes after ageing in service.

Synthetic Compounds

The second section of the paper is concerned with chlorinated synthetic compounds, which are non-inflammable in liquid form. There is doubt about the stability of the chlorinated naphthalenes in liquid form when heated; chlorine tends to be evolved at about 100 deg. C. so they have been little used, except possibly for filling liquid fuses. In the solid form, better known as "Seekay" waxes, they have a limited use in place of bitumen and similar substances.

More common are the chlorinated diphenyls, such as the clophens (Continental) and pyranols (American) used for filling transformers. They have not so far been manufactured in this country, where they are termed "Aroclor." Their relative inflammability depends upon the degree of chlorination, some being self-extinguishing whereas others have no flash point and can thus act as fire-extinguishing media.

Two great drawbacks are price, which in this country is about six times that of ordinary transformer oil; and increasing viscosity with falling temperature, becoming practically solid at 5 deg. C. Thus without thinning by the admixture of some other chlorinated synthetic, such as trichlorbenzene, the only apparent use for the 54 per cent. chlorinated grade is for filling bus-bar chambers and current transformers of switchgear. But the 48 per cent. chlorinated grade is just suitable; the advantage it has over transformer oil as regards cooling by convection at high ambient temperatures would be reversed at 20 deg. C. and become definitely dangerous at temperatures approaching zero Centigrade. "Aroclor" does not sludge or develop acidity; arcing and sparking cause it to decompose, so liberating free hydrochloric acid and probably free chlorine.

Condenser Oils

The dielectric constant of "Aroclor" is about five, compared with two for transformer oil. Thus when used to fill static condensers for power factor correction it provides a 50 per cent. increase in capacitance, but price prevents its wider use for this purpose.

The author's investigations have shown that (under electric stress) oils with an iodine value exceeding 6.5 absorb hydrogen, so tending to counteract imperfect condenser impregnation, whereas oils with an iodine value of less than 6.5 give off hydrogen, so increasing the effects of imperfect impregnation by assisting in the formation of ionisation voids, causing subsequent failure.

Gas-absorbing oil is more liable to deterioration during repetition of impregnating cycles than is highly refined oil with a low iodine value. For reconditioning purposes activated fuller's earth is an efficacious remover of the products of oxidation; an addition of 2.5 per cent. agitated for one hour and then passed through a stream-line filter will clarify the oil, which can be restored in this way many times.

Wiring Regulations

ON November 21st, the Association of Supervising Electrical Engineers held its first technical meeting of the present session, when Mr. E. A. Reynolds lectured on the I.E.E. Regulations. In this he explained the principal differences between the eleventh edition and its predecessor and gave reasons for the alterations made. The discussion that followed dealt mainly with practical difficulties arising out of a strict adherence to the Regulations in certain cases and out of requirements that speakers regarded as ambiguous.

The most important comments related to "earth-free situations"—a new conception in regard to the Regulations—and in his reply Mr. Reynolds gave instances that showed the undesirability of introducing earths into rooms where none existed previously, especially where apparatus with exposed wire elements was used. As concrete hearths were laid on wooden joists, they did not, he said, constitute a real earth. There was, however, the possibility that what was originally

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Trolley-bus Supply (*Continued from preceding page*)

tram rails apparently not being permissible—an additional single-core cable is necessary at 600 V to earth. Possibly, also, added insulation would be required at certain points on the overhead circuit.

A disadvantage of the three-wire proposal is that, as the system is in two halves, regeneration problems would be increased due to the reduction of the number of buses on each network, although at present the value of regeneration—with its sub-station complications—in a flat area is still a matter for argument. There would also be a reduction of standby rectifier capacity, as the normal two bulbs per sub-station are not in parallel, but, with interconnected sub-stations some two miles apart, the shut-down of one of two bulbs on two-wire supply in any sub-station will not appreciably reduce the load on that sub-station owing to the much greater regulation of the overhead circuit against that of a rectifier unit.

To provide full peak-load standby in individual two-wire sub-stations, therefore, spare unit capacity of the rating of one bulb is required, *i.e.*, 50 per cent. in the two-bulb case. An increase of 50 per cent. in the capacity of two-bulb, three-wire sub-stations would also provide peak load standby, but from adjacent sub-stations.

The earthing of interconnected systems should present no more difficulties than with a two-wire earthed supply, the insulated two-wire system having, of course, an advantage in this respect. The mid-wire would have to be solidly earthed at one point only, but with an interconnected system only one sub-station earth could be used at any one time. In order to obviate the rather remote possibility of the mid-wires (on opposite sides of the road) being accidentally open-circuited, it should not be difficult to devise an arrangement at the remaining sub-stations whereby the earth connection was immediately closed upon the mid-wire attaining an excessive voltage to earth.

an earth-free situation might cease to be so owing, say, to the introduction of a gas-pipe later, and that an unearthed portable appliance might be used also in rooms containing earths. The risks would be reduced by the employment of three-pin plugs only, the earth wire not being connected to the socket outlet in earth-free situations. He would abolish the use of lamp-holder connectors.

Diversity could be assumed only when there was no possible likelihood of a circuit being used to full capacity (*e.g.*, a socket on a landing for a vacuum cleaner would not be used for anything else). It would not be legitimate to assume that because the intention was to supply, for example, a 2-kW fire from a point, that a 3-kW fire would never be substituted. His view was that one 15-A socket on a 7/.029 circuit should be the normal practice, the use of two 15-A sockets on a 7/.036 circuit (allowable under the Regulations when diversity justified it) being regarded as exceptional.

Regarding independent control of fixed heating appliances, he believed that Regulation 701 (B) was intended to apply only to high-temperature fires. One reason why this was necessary was to avoid the risk of leaving wires alive in the event of a fire being removed for repairs. High-rupturing-capacity fuses had been shown by tests to be equivalent in the smaller sizes to copper fuses of from 30 to 40 per cent. higher rating.

Replying to a criticism that contractors might incur unforeseen liabilities in giving a certificate that an installation complied with the I.E.E. Regulations, Mr. Reynolds stated that this provision had the approval of the E.C.A., which believed that it would lead to a wider appreciation of the value of the Regulations and of the need for periodical testing.

Electric Steel Production

THE manufacture of steels in electric furnaces is the subject of an important paper by Mr. H. A. Sieveking (Central Electricity Board) which has been issued by the Institution of Electrical Engineers.

The paper contains up-to-date data in graphic and tabulated forms; it commences with brief descriptions of the two principal types of furnace now used, namely, the three-phase graphite or carbon arc and coreless high-frequency induction types. The former is energised by special transformers with high reactance for arc-current limitation and tapped secondary windings for voltage variation (250 down to 60) during service. The 30-ton size is the present convenient design limit for three electrodes, but a 100-ton furnace using six electrodes is actually in service in America. With furnace charges weighing from 0.15 to 30 tons and electrode diameters of from 2.5 to 16 in. the transformer ratings range from 150 to 8,000 kVA for melting and from 95 to 4,500 kVA for "holding" the molten charge.

Induction furnaces provide continuous natural (electromagnetic) circulation of the molten bath, the degree being a function of the frequency; from 500 to 2,250 cycles has been employed commercially with a tendency in this country to prefer the higher frequencies.

Small furnaces for melting precious metals or laboratory uses operate at about 20,000 cycles, derived from spark-gaps. Recently there has been a move towards the employment of 300,000 cycles or more, furnished by thermionic valve oscillators, which adapt themselves to the electrical load. But the majority of h.f. furnaces operate at a fixed frequency near 2,000 cycles, supplied by motor-generators of from 150 to 1,500 (twin) kVA with charges weighing from 5 to 100 cwt. These machines necessitate power factor correction by means of condensers, which may be switched in parallel with the furnace coil automatically by a contact-making power factor meter.

Metallurgical Considerations

The author next reviews the metallurgical factors that have influenced the development of "electric" steels, meaning those produced in electric furnaces. There is a large number of these alloys, some of which can be properly made only in an electric furnace. The h.f. type is not generally regarded as suitable for refining, but at least one large British steelworks is using a 625 kVA standard h.f. furnace solely for this purpose with excellent results. In spite of its very thin walls careful supervision has enabled some 50 charges of 100 cwt. each to be put through before relining, corresponding to one week's working.

The advantages of h.f. furnaces are absence of oxidising atmosphere, no carbon pick-up, good natural mixing of bath and suitability for intermittent operation. Their disadvantages are limited capacity, high capital cost and inability to refine easily, which necessitates the use of raw materials of known composition. In contrast arc furnaces are able to produce steel conforming to rigid analysis from relatively poor raw materials; their capacity is good and cost reasonable, but they tend to oxidise out chromium and vanadium, indifferently mix the bath, are unsuitable for intermittent operation and some carbon is picked up.

The influence of the cost of electricity is dealt with in relation to the several ways in which an electric furnace can be used. Theoretically 340 kWh will melt one ton of steel, but in practice a modern arc furnace requires from 540 to 620 kWh per ton, the overall efficiency ranging from 63 to 55 per cent.; while h.f. melting requires from 600 to 710 kWh per ton, the efficiency being from 57 to 48 per cent.; this lower range is accounted for by the use of motor-generators. Tabulated heat balances and operating data in respect of 20 arc and 25 h.f. furnaces are given in the paper.

Electricity Charges

How the cost of steel produced can be influenced by the form of electricity tariff and the method of operating the furnace (load factor) is indicated, the difference between two cases quoted being nearly 4s. per ton. Most efforts to avoid the consequences of poor load factor have been directed towards the "staggering" of operation, but suggestions that might interfere with maximum output are discouraged. The only remedy, which is also disliked, is to de-rate the transformer and increase the melting time, which the author says may be advantageous on the whole even though rejected when first suggested.

Supply authorities will generally consider a two-part tariff safer, although a flat rate is generally preferred by the consumer. The h.f. furnace appears to be a very desirable load from every point of view; individual units are only infrequently stopped and started, the motor of the motor-generator can be over-excited for correcting the power factor and the load factor during operation is good; fluctuations of power are not severe. About ten minutes after the beginning of the melt the consumption falls to the minimum, when a temperature of about 800 deg. C. is reached, after which the consumption rises again and the charge undergoes a structural change, probably from the ferromagnetic to the paramagnetic state.

Arc furnace operation is different, load fluctuations being violent while the arc is repeatedly striking on one or more phases, until the charge has melted sufficiently to enable the arc to burn steadily. In the case of a 1,500-kVA transformer instantaneous load swings of 1,000 to 2,000 kVA have been noted. It is universal practice to insert reactance for limiting the maximum current drawn from the mains and also for stabilising the arc, usually with as many tappings on the reactor as there are on the transformer. The author shows with the aid of typical load curves and a formula developed in an appendix to his paper that indiscriminate addition of reactance will have a bad effect on the furnace as a whole, without assisting in any way except to reduce the short-circuit current (when all three electrodes simultaneously dip into the bath of molten metal) relative to a predetermined operating current. This result can equally well be achieved by choosing a greater operating current originally, but this necessitates working with a correspondingly bad power factor.

Therefore an arc furnace load is such that with a good operating power factor the short-circuit swings to be accommodated on the mains will be from 1.5 to 2 times the full load current; they will occur during the first half of the melting period and they can be reduced only by lowering input to the furnace at a poorer p.f., assuming that the maximum permissible voltage is applied to the arc.

World Survey

The author next investigates the outputs of the eleven major steel producing countries of the world, details for the last twenty-one years being tabulated, and the influences of national and international economic conditions are indicated. Electric steels are essentially suitable for the production of special alloy steels, which form only a small proportion of the total output, for example, 1.66 per cent. in Great Britain, 1.67 in the United States of America and 3.52 per cent. in Germany in 1937.

This comparison indicates that much of the steel required for armament purposes is necessarily of very high quality, and is therefore made in the electric furnace. It is more freely produced in countries which lack large coal deposits. Those that are rich in coal prefer large open-hearth furnaces, so as to reduce production costs, and the electric furnace is regarded as a small-scale producer intended rather as a source of special steels having a high market value than of mass-produced steel; in other words, the increase in production in those countries will follow the development of the special-steel market. In any country where trade conditions are difficult, for either local or international reasons, the proportion of electric steel (though not necessarily the absolute quantity)

will tend to rise, since such demand as there is for steel will be for small lots quickly delivered, conditions more satisfactorily fulfilled by the electric furnace than by, say, a large open-hearth furnace.

In Great Britain the term "electric steel" must be confined at present to such steels as have a high selling price. The cold-charge process is almost invariably employed, with the result that some 600 kWh of electricity is required merely to melt the charge, before any operation is carried out which will give valuable properties to the steel. This will increase the cost of the steel in billet form by 25s. per ton, without any particular benefit resulting. It is therefore felt that large increases in electric-steel output can be more readily expected from an increased use of the "duplex" or hot-charge process. The weight of finished steel used to-day is far higher than that required in theory.

An electric steel has a very uniform structure, and it would therefore seem possible to reduce the factor of safety at least by an amount sufficient to make the total cost of the steel requirements the same whether the steel is manufactured electrically or by one of the other methods. It is undoubtedly along these lines that Germany is working at the present time in order to reduce her steel consumption to the minimum.

The author calculates that if of the total quantity of steel made in Great Britain only "sections" (35.8 per cent.) and "plates" (16.8 per cent.) were to be produced electrically, then two million tons per annum could be made in 60 furnaces of from 30 to 35 tons. Each would consume nine million kWh per year with a maximum demand of 3,000 kW, at an average price of 0.49d. per kWh. Diversity is ignored and under good conditions a load factor of 35 per cent. could be reached.

Thus if an average selling price of £11 per ton be assumed for this class of steel, the new product would require to be sold at £14.2 per ton. The reduction in total weight due to lower factors of safety would reduce the selling price to £11 again if the reduction were to 77½ per cent. of the present values—a very conservative allowance which would be accompanied by other savings, such as on freight to site, lighter foundations, and greater ease of handling generally.

It is suggested, therefore, that the greatest possibility for extending the use of electric steels, apart from the somewhat limited field of special alloy steels, lies in the production of structural sections and plates, where the uniform crystalline formation will show to the greatest advantage.

Public Lighting in Wartime

Should Restrictions be Relaxed?

THE advisability or otherwise of modifying the black-out restrictions so as to permit some sort of public lighting was discussed at a conference organised by the Association of Public Lighting Engineers at St. Ermin's Hotel, London, on Tuesday. Opening the conference, which was attended by a large gathering from all branches of the public lighting profession, Mr. E. J. Stewart (Glasgow), who had been elected president of the Association at the preceding annual general meeting, said that the black-out would at any rate make the public appreciate street lighting.

Outlining the present official attitude to the question, Mr. C. W. Johnson, of the Home Office, said that in this matter, as in many others, the situation had developed in an unexpected way. The policy was still to have an absolute black-out wherever possible. It had taken quite a long time to achieve a satisfactory black-out and if the restrictions were relaxed at all it might take a considerable time to get back to the present state, if it were found necessary. A total black-out was not possible since lighting was required in such situations as railway marshalling yards, and for urgent building operations, &c. This had been cut down to the minimum, and could be switched off immediately in the event of an air raid.

The question had been raised, therefore, as to whether it would not be possible to have a similar system of street lighting which could be turned off on receipt of a warning, and if so, what would be the effect. The sudden turning off of the lighting might, it was thought, result in panic and so investigations had been proceeding with a view to finding lighting that it would be safe to leave on. Some work on the subject had been done in connection with lighting railway platforms and here an illumination of 0.02 ft.-candle had been found suitable. With the help of the Illuminating Engineering Society, the experiment had been continued from this point in connection with public lighting, but here conditions were quite different, the area being much greater and there being no canopies. Aerial observation had shown that this intensity of light was unsafe and accordingly the experiments were now continuing with a quarter of the lighting, or less.

Bailie Gemmel (Glasgow) said that in Glasgow they could light 20,000 lamps in four seconds, and put them out again in the same time, and he considered that a modified system of lighting should be permitted. If factories, shipyards, &c., could work all night and not be effectively blacked out, why should there not be street lighting too? Both ships and aeroplanes could find their way without the aid of lights.

Mr. Percy Good (British Standards Institution) emphasised that the committee on which representatives of the Illuminating Engineering Society were serving to assist the Home Office in its deliberations, had in no way challenged the decision of the Government with regard to the restrictions, but felt that the proper attitude was to satisfy the authorities that they could give them acceptable street lighting. Street lighting was only one of the problems of the black-out. Many other forms of lighting, such as direction signs, &c., had to be considered, and the way of approach had been to provide an effective system of street lighting co-related with other forms of lighting that would be suitable to the authorities. In making criticisms of the authorities it must be taken into account that they had access to a great deal of information which obviously could not be published. However, he thought that they had now found a satisfactory system of lighting that could be left on without danger.

A speaker from Edinburgh declared that 90 per cent. of the citizens of that city would rather run the risk of an occasional air raid than face the danger of the darkened streets every day of their lives.

Mr. E. E. Hoadley (Maidstone) said that the authorities must get rid of the idea that those responsible for lighting were wanting to do anything that would endanger the public. Actually the present conditions were doing that. There were two ways of dealing with the problem—to have some sort of lighting that could be left on all the time or to have a system which could be immediately switched off. He thought that those town and cities where the lights could be put out in, say, 90 seconds ought to be allowed to have street lighting. He did not believe that the sudden turning off of the lights would cause panic and he did not advocate full street lighting, for the Fighter Command had stated that the light haze from a town could be seen fifty miles away.

The value of public lighting after a raid for mending water mains, sewers, &c., was stressed by Mr. Baker (Yorkshire Electric Power Co.), who agreed with Mr. Good that street lighting was not the only problem, but suggested that it was the most important. Lighting not only after raids but in foggy weather, too, was favoured by Mr. Greenhalgh (Bury), who also suggested the use of light as a means of camouflage. He thought that raiders could find their way without street lighting to guide them. Mr. Bridge (Sheffield) said that lighting authorities were just as keen as the Home Office to make it difficult for raiders, but transport workers were suffering and the accident rate of Sheffield had doubled since the black-out was introduced.

The possibility of having a general lighting of an intensity of 0.005 ft.-candle but to permit a little more in towns where there were facilities for switching off quickly was suggested by Mr. T. Wilkie (Leicester). Mr. Ridley (Co. Durham) maintained that there would be more casualties due to the black-out than there would be by raids, and that it did not say very much for our observers if they could not give sufficient warning. Mr. E. C. Lennox (North-Eastern Electric Supply Co.) believed that the authorities had been right in starting with a complete black-out and then permitting a little light rather than gradually cutting down the amount. On the financial side the adoption of a centralised control system for the street lighting would eliminate the necessity for wardens to operate sirens. Street lighting would improve the public morale. Mr. W. N. C. Clinch (Brighton) could not understand why it was necessary to extinguish signs, &c.

Replying to the points raised, Mr. Johnson said that aircraft could not navigate with the exactitude suggested and street lighting might be just that last indication of position required. Only one town in the country had 100 per cent. centralised control of its lighting. The screening of factories, &c., was being carried out as quickly as possible. Large flares would be of more use than street lighting for repair work after a raid. Decoy lighting to be of any use would have to be done over large areas. Experiments were in progress to give the transport worker more light near his vehicle and to see whether pedestrian crossings could be illuminated. Details of signs for shops would be released in a few days.

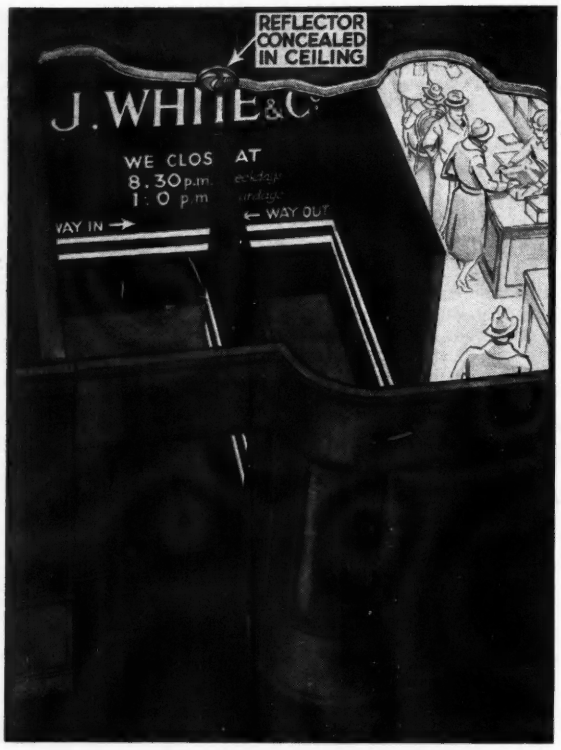
FLUORESCENT SHOP LIGHTING

Alleviating "Black-out" Conditions

By J. B. Harris

THE use of ultra-violet light in association with fluorescent materials has hitherto received most attention in past years in connection with the theatre, but attention is now being given to its employment in connection with lighting during black-outs.

Lamps are obtainable in 80- and 145-W sizes. One of the best reflecting surfaces is anodised aluminium, but mirrored



Proposed treatment of light lock

glass or chromium may be substituted, vitreous enamelled reflectors being definitely avoided due to their high absorption.

Fluorescent powders, when mixed with a suitable binder, may be applied to any surface with a brush or spray gun. In order to protect the paint when used for exteriors, and to facilitate cleaning, a coat of varnish may be applied. For tinting fabrics and other absorbent materials, liquid colourings are obtainable in a great variety of shades. Chalks and crayons are perhaps the simplest form of fluorescent material, the latter being waterproof but somewhat higher in cost. Another material known as "Rhodoid," which has a good daylight appearance and wears well, is obtainable in flat sheets, either polished or matt, 0.012 in. thick, or in thread form. The colours available are rose, green, orange, violet and blue.

The largest scope for the use of fluorescent lighting occurs in shops and stores, especially for indicating clearly to the public the name of the shop and the fact that it is open. Nearly all large stores have an arcade, and ultra-violet light can be projected on to a display card treated with fluorescent paint, placed above the entrance doors. If this is not possible, then the display card and reflector may be placed inside the windows, the location and angle of projection being arranged to avoid direct visibility of the lamp from normal angles of view. Although the rays from these lamps are not dangerous, discomfort may arise due to the "halo" effect resulting from the tendency of the eye itself to fluoresce.

For advertising goods after closing hours liquid colourings may be successfully applied to dresses, hats, coats. Existing reflectors capable of housing 200-W general service lamps may, after substitution of a three-pin b.c. holder, be used for containing a 125-W ultra-violet lamp.

No light must be allowed to escape from the interior of the shop when the doors are open, and light locks should be constructed in accordance with B.S. Specification A.R.P./15. For providing the low level of illumination needed in a light lock, a shop window reflector of an asymmetric type, housing an ultra-violet lamp, can be installed in the ceiling of the structure.

Two white lines, each 2 in. wide, at distances of 2 ft. 6 in. and 3 ft. 6 in. from floor level, are painted round the walls of the light lock. The walls may also be decoratively treated with fluorescent paint, indicating the hours of closing, together with directional arrows, and any step should also be indicated with paint.

For interior display work fluorescent materials, such as Rhodoid flowers and foliage, may be introduced and a novel effect is created by lighting a display with both ordinary lamps and ultra-violet lamps, the former being on a flasher. By selecting suitable paints the objects may be made to appear in alternate colours. Such features may be used after hostilities have ceased, and should, therefore, not be considered solely from an emergency point of view. The sale of ultra-violet lamps and equipment should help in some way to offset the lack of business resulting from the absence of normal window lighting.

Wimbledon Tariff Case

Judgment Reserved

IN the Chancery Division, before Mr. Justice Simonds, on November 22nd, the hearing was continued of the test action brought by the Attorney-General at the relation of Major C. H. Stevens, of Worple Road, Wimbledon, and by the Major as a second plaintiff against the Wimbledon Corporation, claiming by way of declarations and an injunction that the two-part tariff of the defendant Corporation for electric light and power supplied to the Major's house was invalid and *ultra vires*. The facts of the case were reported in our last issue.

Mr. A. E. Mackenzie, the chief electrical engineer and manager, in cross-examination by Mr. Harman, K.C., for the plaintiffs stated that after the writ in the action was issued he had issued a notice on May 11th, 1937, stating that whenever it was found necessary to increase the size of a meter which had been installed in a house where the domestic two-part tariff was in force an increase in the fixed annual charge must also be considered and that any such cases were to be brought to his personal notice. After that a scrutiny of meter readings was carried out and five assessments were increased. Whenever a consumer installed an unusual amount of apparatus the case had to be brought to his personal notice. These cases were almost all among the larger houses. The smaller houses often used more electricity for heating than the larger ones but the latter were assessed higher on the probable maximum demand.

Mr. Arthur Collins, financial adviser to local authorities, gave evidence that he had had considerable experience in dealing with the finance of electrical undertakings. He explained the nature and operation of two-part tariffs.

His Lordship said he did not propose to accede to the plaintiff's claim that a two-part tariff was *per se* illegal. What he had to consider was whether the Major got his supply on the terms to which the statutes entitled him. Mr. Collins, he said, could be asked what circumstances ought to be taken into consideration in framing a two-part tariff.

Mr. Collins replied that the first thing for consideration was the cost of supply, which ought not to be a burden on the ratepayers. The principal basis used for two-part tariff were first the rateable value basis and secondly the floor area basis. When houses were spread over a considerable extent the rateable value basis was of not much use and the supply authorities had to take into consideration the cost of any exceptional demand. He thought that the unit charge at Wimbledon was very reasonable.

On November 23rd leading Counsel for the respective parties addressed his Lordship and at the conclusion of their speeches judgment was reserved.

PERSONAL AND SOCIAL

Information regarding new appointments and other matters of interest for this page are welcomed

TRIBUTES to the work of **Mr. C. F. McInnes,** for thirty-seven years borough electrical and consulting engineer, were paid at a gathering at Gravesend Town Hall on November 21st when Mr. McInnes, who retired on September 30th, was presented by his former fellow officials and members of his staff with a silver teapot and a silver hot-water jug, each inscribed and engraved with the Borough Arms. The Mayor (Councillor W. C. Fletcher) presided and was supported by Ald. J. W. Clunn, chairman of the Electricity Committee, and Mr. H. H. Brown, Town Clerk.

Mr. E. B. Moullin, M.A., chairman of the Wireless Section of the Institution of Electrical Engineers, was educated at Cambridge and was a University lecturer there from about 1921 to December, 1929, when he was appointed Donald Pollock Reader in Engineering Science in the University of Oxford, and shortly afterwards a Fellow of Magdalen College. His duties have been to teach all branches of electrical engineering, but his main study has been radio communications and this has been his hobby since 1909. In the years immediately after the last war he did a great deal to advance the practice of radio-frequency measurements, and in 1922 he invented and patented the original thermionic (Moullin) voltmeter which was licensed to the Cambridge Instrument Co., Ltd. In 1926 Mr. Moullin published the first book devoted to radio frequency measurement. About 1927 he developed a standard ammeter for very high frequencies and he has also designed several other instruments for precision radio measurements. He has been a member of the Radio Research Board of the Department of Scientific and Industrial Research for about six years and has served two periods on the Wireless Section Committee of the I.E.E., being vice-chairman in 1938.

[H. J. Whitlock & Sons, Ltd.
Mr. E. B. Moullin

Since he has been in Oxford, Mr. Moullin has led a school of radio research : the main problems which have been tackled are background noise in radio receivers due to thermal agitation and shot effect and the mechanism of energy loss in dielectrics. Last year he wrote a book entitled " Spontaneous Fluctuations of Voltage," and a general survey of the second problem forms the subject of his chairman's address to the Wireless Section. He has devoted much time to the theory of wireless aerials, and is the author of three authoritative papers on this subject. He is also the author of " Principles of Electromagnetism " and between 1926 and 1931 published several papers and did much experimental work on vibration problems in naval architecture.

Mr. T. G. Darby, a member of the staff of the County of London Electric Supply Co., Ltd., has been presented with a canteen of cutlery by his colleagues at the Chelmsford offices and Wickford showrooms, on the occasion of his marriage to Miss Muriel Chapman, of Wickford.

Mr. J. F. Urquhart, B.Sc., who has been district mains engineer with the Scottish Southern Electric Supply Co., Ltd., for the Berwick, Berwickshire and North Northumberland area since 1937, has taken up a post as mains superintendent with Perth Corporation. Before going to Berwick Mr. Urquhart was attached to the Galashiels and later the Duns offices of the company.

Mr. J. McIntosh, A.M.I.E.E., has been appointed acting telephone manager of the Edinburgh Telephone Area in place of Lieut.-Col. J. F. Darby, T.D., at present on active service. Mr. McIntosh entered the telephone service in 1902, and during the past three years has been area engineer in Edinburgh.

Mr. H. G. Coleman, J.P., has been elected a member of the London and Home Counties Joint Electricity Authority.

Glasgow Corporation Electricity Committee has placed on record its appreciation of the valuable services rendered to the Electricity Department over a period of forty-two years by **Mr. J. H. Irons,** resident engineer at Dalmarnock generating station, who retired from the service on October 29th, on attaining the age limit. The manager reported the promotion of **Mr. T. A. Robertson,** assistant station engineer, to the position of station engineer at Dalmarnock.

Mr. F. Overstall, A.M.I.E.E., has recently been appointed mains engineer to the Birkenhead Corporation Electricity Department. After receiving his technical education at the Manchester College of Technology and serving an apprenticeship with the Rawtenstall Corporation, Mr. Overstall held appointments in the mains departments of the Aylesbury Corporation and the Northampton Electric Light & Power Co. In 1930 he was appointed senior assistant mains engineer to the Birmingham Corporation, which position he is relinquishing to take up his new duties.

Mr. E. J. Cripps, proprietor of the Wallace Electrical Co., is now serving as captain in the Royal Army Ordnance Corps.

Mr. P. McFall, for some years sales engineer in Scotland for Wm. Sanders & Co. (Wednesbury), Ltd., has been appointed to the London office where Commander Preston and he will be jointly responsible for its administration.

It is announced that at the Christmas Quarter Court of the Clockmakers' Company, Henry John Thomas and Gordon Edward Cowlett were apprenticed to **Mr. E. E. Sharp,** managing director of Venner Time Switches, Ltd., and the Master Elect of the Worshipful Company. Henry John Thomas was awarded a scholarship given by the Clockmakers' Company to students attending the classes in horology and instrument making at the Northampton Polytechnic Institute, and both these apprentices are working out their articles with Venner Time Switches, Ltd.

At a meeting of the Executive Council of the Association of Supervising Electrical Engineers, held in London on November 25th, the chairman (Mr. J. J. Smith, A.M.I.E.E.), on behalf of past and present members of the Council, presented a silver tea set to **Mr.** and **Mrs. Albert Brammer** to mark the celebration of their twenty-fifth wedding anniversary on September 26th, and as a symbol of the esteem and affection in which they are held by their many friends within the Association. Mr. Brammer has been general secretary of the A.S.E.E. since 1921, and the chairman paid tribute to the capable and energetic manner in which he has always carried out his duties. The part played by Mrs. Brammer in the social and other spheres of the Association's activities was referred to by Mr. F. W. Smith (vice-chairman of the association), and her support was gratefully acknowledged by Mr. Brammer, who, in expressing his thanks, referred to the assistance he had always received from the members of the Council.

Mr. H. L. Howard, M.I.E.E., M.I.Mech.E., general manager of the Electricity Company of Macclesfield, Ltd., was last week presented by the staff with parting gifts. The undertaking is about to be transferred to the Macclesfield Corporation. Mr. Howard, in responding, said it was seventeen years since he first took over control of the concern.

Commdr. F. J. Campbell Allen's only daughter, Miss Clarinda Campbell Allen, and Mr. Chris Attlee, nephew of the Rt. Hon. C. R. Attlee, Leader of the Opposition, have recently announced their engagement. Commdr. Campbell Allen, who is joint managing director of Bastian & Allen, Ltd., is now serving in the Royal Navy.

Mr. G. W. Raby, assistant general manager of the English Electric Co., Ltd., Rugby, who was a flying officer in the last war, has volunteered once again and has left for France, with the rank of acting captain. Before he left the works on November 21st he was presented by the office staff with a pair of binoculars, and he also received a gold watch from the works staff.

The Home Secretary has appointed **Mr. H. R. Rogers** and **Mr. H. Topham,** at present Superintending Inspectors of Factories, to be Deputy Chief Inspectors of Factories as from January 1st consequent upon the retirement of Sir Duncan Wilson and Mr. G. S. Taylor from their present posts of Chief and Deputy Chief Inspector respectively.

OBITUARY

Mr. R. Dumas.—The death occurred on November 20th of Mr. Robert Dumas, of Leamington, at the age of seventy-four. Forty years ago he was mechanical superintendent at the Stafford works of Siemens Bros. In 1903 he joined the staff of the General Electric Co., Ltd., and three years later he was appointed works manager to Bruce Peebles & Co., Ltd. In 1908 he joined the B.T.H. and was works manager until 1929. He retired in June last, and until then he had acted in an advisory capacity as consulting engineer to the company, and had represented it on the Engineering Employers' Federation. During the last war he was at the Coventry factory of the B.T.H. Co.

Sir John Rumney Nicholson, who died recently at Keswick (Cumberland), was at one time connected with Black, Hawthorn & Co., Ltd., Gateshead, and was resident engineer in charge of the erection of the first generating station of the Newcastle-on-Tyne Electric Supply Co., Ltd., at Pandon Dene. in 1889. Sir John, who was seventy-three years of age, was docks engineer for the North-Eastern area of the L.N.E.R. before his retirement.

Mrs. E. G. Crompton.—The death occurred on November 27th, in her ninety-third year, of Mrs. Elizabeth Gertrude Crompton, wife of Col. R. E. B. Crompton. Many of our readers will wish to join us in expressing deep sympathy with Col. Crompton in his great loss.

NEW BOOKS

Boiler Water Conditioning. Factory Act Commentaries. School Services.

Boiler Feed Water Treatment. Second Edition. By F. J. MATTHEWS. Pp. 319; figs. 31 and photographs. Hutchinson's Scientific and Technical Publications, Paternoster House, London, E.C.4. Price 12s. 6d.

We did not have the pleasure of perusing a copy of the first edition of this book, and our first reaction after a quick glance through the contents and subject matter of the present edition was one of some disappointment. Reading the author's prefaces and the publisher's notes it is ascertained, however, that the book is intended as a guide to the "ordinary" or "small average" steam plant operator. This description of the text is fully justified, and we confidently recommend this book to engineers, and also chemists, who have such boiler plant under their care.

The chemistry involved in boiler water treatment is given in simple but at the same time a commendably dignified manner, and numerous diagrams and illustrations are included. The contents are broadly divided into five parts: natural water supplies, scale formation, corrosion, foaming and priming, analysis and routine testing, together with an appendix which deals with standard solutions, reagents, chemical factors, &c.

The details given on scale formation are very good, and this is particularly so in the many methods explained for the prevention of this major trouble in steam raising plant. Almost all known causes of scale formation are catered for and remedies suggested. Orthodox methods of water softening with a particular end in view are not only described, but their limitations are also discussed. Internal water softening, *i.e.*, making the boiler the softener, is mentioned at length, and this, together with the account of colloidal treatment and boiler water conditioning, should be of considerable interest to users of low- and medium-pressure boilers.

Corrosion in theory and practice is given a prominent position, and we are glad to note that the difference between "soft" and "softened" waters is given the space it deserves. Hydrogen ion or pH value is explained in detail and useful information given for its application. The chapter on priming and foaming will be of interest to engineers and also chemists, many of whom will no doubt gain some useful tips from Part 5—analysis and testing. Quite good references terminate each part, but the index is a very poor ending to an excellent little book.—F. K.

The Factories Act, 1937. By H. SAMUELS. (Pp. 702.) Stevens and Sons, Ltd., 119, Chancery Lane, London, W.C.2. Price £1 10s.

It is perhaps just as well, in view of the increased tempo that is likely to characterise factory activity in this country under war conditions, that we have in the 1937 Factory Act an elaborate code designed to lessen the toll of industrial accidents and to safeguard the health and welfare of the worker. The new Act not only consolidates existing law but also imposes several new and far reaching enactments. Many factory occupiers have not as yet fully acquainted themselves with these new obligations.

About half of the book is devoted to a complete reprint of the Act itself with copious footnotes to each section. In these footnotes the author shows how far each section replaces or amplifies previous legislation, and explains the effect and application of each new section. In addition, he gives, in a seventeen page introduction, a précis of the new enactments. The final half of the book is a reprint of earlier legislation, made up mainly of regulations for dangerous trades such as the 1925 regulations for the manufacture and repair of electric accumulators.

One of the features of the new Act is that the basis for proceedings has been widened. For instance, it is now possible for proceedings to be taken against a director or officers, if responsible for negligence, in addition to the company. While, therefore, this book can scarcely be recommended as light reading it obviously demands attention from those whose duty it is to see that regulations are observed.—A. W. W.

Handbook to the Factories Act and Truck Acts. By JOSEPH OWNER. Second edition. Pp. 151. Pitman & Sons, Ltd., London. Price 5s.

The Factories Act, 1937, which came into operation last year, made considerable modifications of and extensions to the law previously in force. Owners and occupiers of factories as well as factory workers have, therefore, to acquaint themselves with their obligations, and as the Act with the numerous Regulations made under it constitutes a formidable bulk, they will welcome a book which explains in simple terms what their duties are.

The author, having been a factory inspector for some years, has had a wide experience of factory legislation and is able to translate legal provisions into practical language with which people in factories are familiar. He is also able to emphasise those features in the new Act to which special attention must be given. Being a handbook and not a legal treatise, the book does not follow strictly the textual order of the Act, but after a short historical introduction, commences with a description of the premises to which the Act applies. This is quite adequate, though the paragraph dealing with electrical stations might have included a reference to convertor stations and also made it clear that some of the provisions of the Act may be made applicable to electrical plant and machinery not on factory premises.

The chapter on health and welfare requirements embodies not only the provisions of the Act, but also various Regulations made under it. It describes and illustrates the kind of facilities for washing, ventilation, and escape from fire which will satisfy the requirements of the Act. When dealing with safety appliances the author rightly emphasises the necessity for adequately fencing moving machinery, and he offers numerous practical hints culled from experience on how safety can be ensured. The chapter on accidents and dangerous processes describes the procedure for notification and contains a list of Home Office Regulations applicable to various dangerous trades.

Only about five pages are devoted to the Truck Acts, and this is hardly sufficient. The application of these Acts is fraught with difficulty as the recent case of Cook, Son & Co. *v.* Pratt showed, and the author's notes must only be regarded as giving a very bare outline. All who have duties and obligations in factories, both employers and employees alike, should find this little book very useful. It is practical in its treatment of the subject, convenient in size, and reasonable in price.—J. W. T.

The Heating, Ventilation and Lighting of School Buildings. By W. D. SEYMOUR. Pp. 214; fig. 52. Oxford University Press, 11, Warwick Street, London, E.C.4. Price 12s. 6d.

This is a book of special interest to electrical engineers as it deals with recent investigations conducted by a member of the National Institute of Industrial Psychology into the heating and lighting of schools old and new.

The author concludes that existing artificial lighting standards are usually well below the 10 ft.-candles desirable at desk levels in ordinary classrooms and the 12 to 18 in many practical rooms. Diffused light from opal spherical fittings is favoured. Particular illumination problems in technical colleges and institutes are discussed. Local lighting of lathes and machinery of all kinds is considered, and this means that the electrical engineer must be fully aware of the various purposes to which different kinds and different parts of schools have to be put. That is, the lighting scheme has to be completely functional. Plans are included of ideal layouts with wattage of lamps for standard-size classrooms of different types which should be most useful when considering specifications.

The place of electric heating systems in schools receives close analysis. For low-temperature panel or tubular heaters, electricity has to be available at 0.33d. per kWh if the system is to compete with coke-fired boilers. The comparative costs take into account all consequential savings, such as economy in labour, but the difference between loan charges on an electrical installation and on a low-pressure hot-water system does not appear to have been allowed for in the calculation. The former can be as little as one-third the value of the latter. High-temperature parabolic heaters receive a distinct fillip from the report, both on the grounds of efficiency and comfort as well as of comparative costs.—F. E.

Shorter Notices

"Look After Your Car." By the Technical Staff of *The Autocar*. Pp. 116; illustrated. Iliffe & Sons, Ltd., Dorset House, Stamford Street, London, S.E.1. Price 2s. 6d.—This reprint of a series of articles published in *The Autocar* tell the owner-driver in simple non-technical language how to keep his car in good condition, safe and easy to drive. All photographs adjoin the explanatory text. Advice is also given on how to form the nucleus of an efficient workshop.

"Die-Casting.' By ARTHUR STREET. (Pp. 160; figs. 47.) Emmott & Co., Ltd., 28, Bedford Street, London, W.C.2. Price 4s. 6d. So extensively are die-castings used to-day that the author has prepared this work in the form of a manual for the user, buyer and designer. After pointing out the merits of die-casting he gives a great deal of information on its different aspects, the choice of alloys, machining, plating, finishing, assembling, die life, cost, &c. A particularly interesting chapter deals with the combination of plastics and die-castings.

"Electricity and Magnetism." By JOHN B. WHITEHEAD. (Pp. 221; figs. 96.) McGraw-Hill Publishing Co., Ltd., Aldwych House, London, W.C.2. Price 19s. 9d.

"Mathematics Applied to Electrical Engineering." By A. G. WARREN. (Pp. 384; figs. 132). Price 15s. "Fluorescence Analysis in Ultra-Violet Light." By J. A. RADLEY and JULIUS GRANT. (Pp. 424; figs. 28.) Chapman & Hall, Ltd., 11, Henrietta Street, W.C.2. Price 22s. 6d.

NEW ELECTRICAL PRODUCTS

A Review of Equipment Recently Marketed

Electric Poker

An electric poker which will light a coal, coke or anthracite fire or domestic boiler is the latest achievement of MORPHY-RICHARDS, LTD., St. Mary Cray, Kent. Loaded at 800 W the poker takes from three to ten minutes to kindle the fire, according to the size. The tubular "Backer" element used has been specially designed to operate at high temperatures and withstand the severe conditions to which it is likely to be subjected, but the makers warn users that if the poker is left in the fire after it is well alight the combined heat of the fire and the element will make the latter too hot and its life will be shortened. The construction throughout is exceptionally robust and it has a neat appearance. A wooden handle is provided, while the stem is chromium plated.

Morphy-Richards electric poker

Small Rotary Convertors

Commutators and slip-ring assemblies of unusually heavy build for their size characterise the range of small rotary convertors offered by C. F. WARD, 46, Farringdon Street, London, E.C.4. They are of sturdy construction, machines rotating above 2,000 RPM having phosphor-bronze bearings with shaped oilways in conjunction with an absorbent lubricating wad. Dynamic balancing minimises vibration, the armatures being double wound for operating radio receivers and amplifiers, with power factors of 85 to 100 per cent. and all-wave filtering from 5 to 2,000 metres.

Both single- and double-wound types are available for energising neon signs with 40 to 60 per cent. power factors, and terminal condensers to suppress interference with radio reception. There are machines for DC inputs between 12 and 250 V for AC outputs of 60 to 250 W at up to 250 V, 50 cycles. For an extra charge they can be supplied with an extended shaft to function as self-excited generators. There are also DC/DC rotary transformers for 6 to 250-V inputs, and outputs of 60 to 160 W at from 100 to 500 V.

A Handsome Kettle

A kettle just introduced by the GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, W.C.2, is a welcome departure from the orthodox and a handsome addition to the sideboard. It has a spherical body, a straight spout and a "basket" type handle covered with a heat-insulating material moulded to afford a comfortable grip. The lid is of large diameter, for easy filling, with a neat flat lifter, and it has two sets of vents which direct the steam forward well clear of the hand.

G.E.C. kettle as part of a silver tea service

The shape of the handle, combined with the careful balancing of the weight, makes pouring extremely simple and safe. Stout-gauge copper is employed for the body; the interior is heavily tinned and a substantial chromium plate finish beautifies the exterior. An immersed element loaded at 1,500 W is fitted, and it will boil three pints of water in 7½ minutes. The kettle will actually hold nearly four pints when filled to the top. An ejector type safety device protects the element.

Our picture shows that the new kettle goes well with a silver tea service.

A Lightweight Blower

For blowing out instruments and switchboards in cases where the "Standard" or "Mill-type" models are too powerful, the MARTINDALE ELECTRIC CO., LTD., Westmorland Road, London, N.W.9, has just brought out a smaller version of its "Super-Blowers" called the "Blower-Clean."

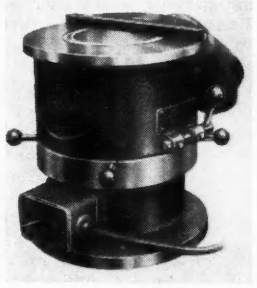
Martindale "Blower-Clean"

Although weighing less than 8 lb., this neat little machine discharges 55 cu. ft. of free air per minute at a nozzle velocity of 404 ft. per second and develops a "U" water tube column pressure of 29 in. The blower is precision built and carefully balanced to prevent vibration. The armatures and field coils are hand wound and all windings are impregnated to withstand use in tropical climates and under the most exacting industrial conditions. The cast aluminium housings are machined to give 100 per cent. interchangeability.

By the use of a set of standard attachments the machine can be converted into a portable industrial vacuum cleaner.

Table Surface Grinder

A new 8-in. table surface grinder has been designed by WRIGHT ELECTRIC MOTORS (HALIFAX), LTD., Century Works, Pellon Lane, Halifax, to meet the demand for a reliable but moderately priced machine in the fitting departments of engineering works, garages and aircraft factories, and for machining metal when a high degree of accuracy is not required. It is available either for bench or floor mounting, the worktable level in the latter case being 34 in. Both types are fitted with automatic dust extractors incorporating a large diameter fan mounted on the motor shaft, while compensation for the wear of the carborundum wheel is obtained by vertical movement of the table through rotation of a large nut.

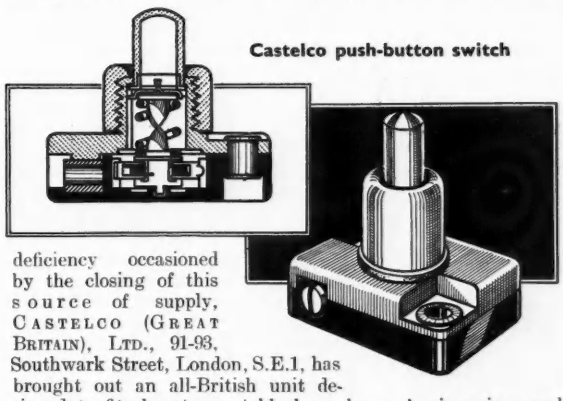


Wright bench type surface grinder

The 1-HP motor, which is available for various voltages, operates at 2,850/3,000 RPM and is of the squirrel-cage, totally enclosed, dustproof type. Roller bearings are used at the top, with deep groove ball-bearings at the bottom. A quick-break "Arrow" starting switch is enclosed in a dustproof c.i. case. The bench type weighs 200 lb. and the pillar type 320 lb.

Push-button Switches

Before the war started a very large number of the push-button switches used for incorporation in the bases of table lamps, &c., came from Germany. To help make good the deficiency occasioned by the closing of this source of supply, CASTELCO (GREAT BRITAIN), LTD., 91-93, Southwark Street, London, S.E.1, has brought out an all-British unit designed to fit almost any table lamp box. An ingenious and robust operating mechanism embodies a spiral and ratchet device, with heavy brass contacts. The switch is available in either brown or white bakelite and is rated at 2 A, 250 V. It is the first of a range of switches which the company proposes to develop.



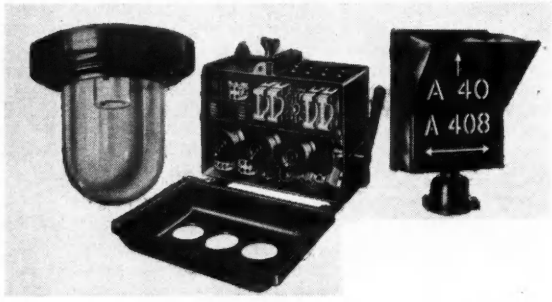
Castelco push-button switch

A.R.P. EQUIPMENT

Special Apparatus Designed to Meet Present Needs

Low-intensity Lighting

A WHOLE range of lighting equipment for air-raid shelters and for general illumination of low intensity is now obtainable from the REVO ELECTRIC CO., LTD., Tipton, Staffs. Descriptions of the company's special reflectors designed to conform with BS/ARP/16 and 20 have already appeared in the ELECTRICAL REVIEW (September 22nd, page 397, and October 27th, page 556). To these units a third has now been added, the "IES/ARP 0.2," which complies with BS/ARP/21 and provides an illumination of 0.2 ft.-candle. It is constructed of sheet steel, finished in sprayed aluminium, and can be fitted to existing b.c. lampholders, housing lamps of 15, 25 or 40 W according to the mounting height. Any of these three special units can be supplied for pole mounting, the assembly comprising a 9-in. projection bracket, adjustable



Revo well-glass fitting for air-raid shelters, a change-over lighting controller and an illuminated road route number indicator

clamps, a weatherproof dome, and, if required, double-pole fuses for attachment to the underside of the bracket arm.

Three lighting units intended particularly for air-raid shelter lighting include a cast-iron bulkhead fitting for wall or ceiling mounting; a well-glass type consisting of heavy-duty glass fitted to a cast-iron dome; and another well-glass unit with the glass secured to a 5-in. enamelled or imitation walnut block by means of a cast-iron ring. All these fittings comply with BS/ARP/6 and so does a change-over lighting controller which incorporates a transformer wound to feed nine points of 10 W each at 12 V. Included in this unit, which is housed in a galvanised iron case, is a change-over switch so designed that either two circuits of five and four points are mains fed, or alternatively a circuit of five points is battery fed. Four 15-A single-pole fuses are incorporated and there are three 5-A tumbler switches for main and sub-circuit control.

"Maskalite" gas-mask container

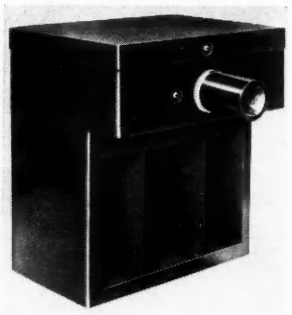
In addition to illuminated route number and refuge indicators, the company has also brought out a unit specially designed to illuminate standard road direction signs and A.R.P. signs with a brightness not exceeding 0.1 ft.-candle. The fitting is strongly made of sheet metal and easily attached by brackets and set pins. The sign is in no way obscured by the fitting.

Mask Container with Torch

A cylindrical metal gas-mask container incorporating a shielded torch in the base is now available from F. CROWL & SON, 53, Bushwood Road, Kew, Surrey. The "Maskalite," as it is called, is being produced in black crackle finish with hand-sewn black leather strap or in plain cream finish with a nut-brown strap.

Road Direction Sign

The Ediswan "Controlume" fitting has been developed by the EDISON SWAN ELECTRIC CO., LTD., 155, Charing Cross Road, London, W.C.2, to meet the exacting requirements of the Lighting Restrictions Act, which demands a definite illumination for authorised signs which have to remain legible during the black-out and even during an air raid.



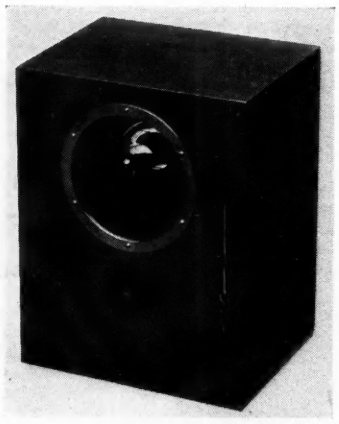
Ediswan "Controlume" fitting

The fitting must be used only with a 15-W, 28 mm. pygmy sign lamp, access to which is readily obtained by removing the detachable cover at the top of the unit. Accurate control of the light output and distribution is obtained from an optical system comprising a specially calibrated reducing screen in conjunction with adjustable shutters. These confine the light to the face of the sign panel, thus preventing a direct view of the source and illumination of the ground.

At the back fitting a ¾-in. conduit socket is provided for direct attachment to a conduit arm, but an alternative mounting can be effected by means of a mild steel strap suitable to the particular situation. The fitting is designed for illuminating sign panels up to 48 in. wide by 36 in. deep.

Detecting Incendiary Bombs

Incendiary bomb detectors which function in conjunction with various warning devices have been developed by BAIRD TELEVISION, LTD., Anerley Hill, Crystal Palace, London, S.E.19, and are being marketed through the usual electrical and radio trade channels. Demonstrations have substantiated the maker's claims as reasonable, since success in the suppression of fire depends not only upon immediate indication of its outbreak, but also upon ability quickly to determine the source of its origin.



Baird incendiary bomb detector

The principle upon which the Baird detector operates is based on a well-tried method, whereby any sudden or appreciable increase of the normal amount of light usually present in the vicinity of the detector, such as is likely to result from an explosive flash or ignition flame, causes a light-sensitive cell to upset the electrical balance of a thermionic circuit, thus enabling a single amplifier valve to energise a relay for actuating audible and/or visual signals. The components are simply arranged in a strong wooden or iron-clad box.

Model A operates off the ordinary AC mains, having a consumption of 10 W and intended for use with a continuously ringing warning bell having its own local battery. It is so arranged that accidental circuit interruption will be revealed by the ringing of the bell. In addition to these features model B has an extra relay circuit whereby inadvertent switching off is indicated by a visual signal instead of the main alarm bell. Model C is similar, but designed for DC mains operation, while Model D is battery operated.

An adaptation of the basic circuit enables the device to be employed as a flash and/or smoke detector. This is done by combining two light-sensitive cells in series potentiometric fashion, one beam of light exciting both. Thus if the illumination to which the cells are responsive is increased by a flash in the one case, or diminished by intervening smoke in the other, the amplifier-relay will function.

CONDITIONS IN EGYPT

Competition in Electrical Trade

IN the report by Mr. C. Empson, H.M. Commercial Secretary at Cairo, compiled before the outbreak of war, on economic and commercial conditions in Egypt, emphasis is naturally laid on the discouraging outlook at that time for the country's great staple product, namely, cotton. A steady decline in the market had brought prices about 25 per cent. below the level of two years before, while a poor and meagre crop in 1938 aggravated the situation.

Since the outbreak of hostilities, however, the cotton market has improved and the outlook, although not free from uncertainty, is undoubtedly more promising than it was a few months ago. For this reason and also because of the considerable trade done by Germany with Egypt, which is now cut off, Mr. Empson's report is worth examination by firms who have an export surplus of manufactures either ready or in prospect. It may be recalled that in the August 4th issue of the ELECTRICAL REVIEW attention was directed to the low prices quoted by Continental firms, notably German.

Exchange control has been instituted in Egypt, and every cash or forward transaction in foreign currency other than the pound is now forbidden unless the transaction is justified by the normal needs of commerce and industry or by special private requirements. Since the beginning of the war banks for the most part have curtailed credits to all but regular customers.

It will be well for British interests to watch the development of local manufacture in Egypt, as to which Mr. Empson devotes an interesting section of his report. The Government continues actively to foster the establishment and extension of local industry, protecting local manufacturers by high tariff walls, and the system of advances to promoters through the Misr Pand has been maintained. The report states that progress has recently been slow, mainly because the necessary capital has been difficult to attract, and the participation of foreign funds has been deterred by international uncertainties. Presumably the latter drawback has grown in strength since Mr. Empson's report was written, but on the other hand it may be recalled that during the last war there was a great impetus to factory enterprises in many countries by reason of the difficulty of obtaining finished goods from abroad.

In the electrical apparatus industry some progress has already been made and there are now two factories reported to be turning out electrical fittings and lamps. One of them produces 5,000 lamps daily. The local manufacture of neon tubes, for advertising and other purposes, has also developed and a number of small concerns are engaged in this industry.

Recently the Egyptian Ministry of Trade and Industry decided to establish an institute for industrial research, in which would be included the various technical sections of the Ministry dealing with leather, glass, chemicals and textiles. The necessary instruments and equipment will be purchased as soon as a programme has been drawn up. One object will be to reduce the country's dependence on imported goods.

Mr. Empson comments on the lack of detail in the classification of the foreign trade returns. As a whole the imports of electrical apparatus and machinery rose in value from £E569,420 in 1937 to £E736,437 in 1938, these figures excluding radio apparatus which is dealt with separately. While the increased supply of electricity in Egypt has stimulated the more general use of industrial electrical machinery, it is disappointing to read that the high cost of energy is discouraging the adoption of electric household equipment.

Last year the United Kingdom's share of the trade in generators, motors and transformers decreased as compared with the previous year, whereas Germany gained ground. Imports from all countries amounted in value to £E131,944 against £E85,376 in 1937. On the other hand, in the trade in electric wire and cables the share of the United Kingdom rose from 5½ per cent. to nearly 20 per cent., thus bringing it second after Germany, with Belgium and France following closely. The trade in radio sets, after having increased nearly 25 per cent. between 1936 and 1937, went back to the 1936 level. The Commercial Secretary ascribes the decline mainly to the deterioration in the financial position of many small dealers, especially in the provinces. United Kingdom manufacturers gained ground steadily during the period under review, their share of the trade advancing from 11 per cent. in 1936 to 13 per cent. in 1937 and 15 per cent. in 1938.

In the scheme for developing hydro-electric power at the Aswan dam and manufacturing nitrate fertiliser in connection with it, no definite progress is announced, but the Government, Mr. Empson points out, has at various times reiterated its intention of proceeding with the project.

Since Mr. Empson's report was written figures for the half-year have become available, and those relating to electrical imports are set out above. The grand total, at £E456,000, was about the same as for the first half of 1938. The only items showing noteworthy changes were submarine and underground cable and unspecified apparatus. (The Egyptian £ equals 20s. 6d.)

EGYPTIAN ELECTRICAL IMPORTS

	Jan.-June 1939 £E(000)	Inc. or dec. on Jan.-June 1938 £E(000)
Generators, motors and transformers, 1,000 kW or over—		
Total	24	+ 3
From United Kingdom	7	+ 4
,, Germany	15	+ 7
Ditto, 50 to less than 1,000 kW—		
Total	24	− 1
From United Kingdom	6	− 1
,, Germany	5	—
Ditto, less than 50 kW	10	+ 2
Dry batteries and parts—		
Total	11	+ 1
Accumulators and parts—		
Total	19	+ 3
From United Kingdom	9	+ 3
,, Germany	3	—
,, United States	3	+ 1
Fans, electric—		
Total	3	—
Wireless valves—		
Total	4	—
Electro-medical apparatus—		
Total	18	+ 1
Electric lamps—		
Total	26	− 2
Telegraph and telephone apparatus—		
Total	26	− 9
From United Kingdom	20	—
Radio receiving sets—		
Total	50	− 2
From United Kingdom	5	− 3
,, Germany	9	+ 4
,, Holland	13	+ 2
,, United States	19	− 6
Radio fittings and parts—		
Total	16	+ 7
Submarine and underground insulated cable—		
Total	43	− 33
From United Kingdom	3	− 18
,, Belgium	11	+ 2
,, France	8	− 15
,, Germany	16	+ 7
Other insulated wire and cable—		
Total	29	+ 1
From United Kingdom	4	− 1
,, Belgium	5	− 1
,, Germany	11	+
Insulated tubes, metal-covered—		
Total	2	—
Signalling apparatus—		
Total	11	+ 7
Refrigerators—		
Total	6	+ 2
Water heaters—		
Total	1	—
Other domestic apparatus—		
Total	4	—
Electrical apparatus, not specified—		
Total	123	+ 29

The National Joint Board

AT a recent meeting of the National Joint Board of Employers and Members of Staff Electricity Supply Industry) a proposal that the Central Electricity Board should become a member of the National and District Joint Boards was discussed. The staff side pointed out that while the C.E.B. used the N.J.B. Schedule as a kind of basis for fixing the salaries of its staff it was a law unto itself and the staff had no method of appeal from its decisions. The employers' side considered that it was undesirable that the Central Board should become a member. The staffs in stations operating under the Central Board's directions were already covered by the Schedule as station owners were represented on the N.J.B.

At the same meeting it was reported that the staff side had agreed to accept the employers' offer of increased salaries for certain members of the staff of the Barton (Manchester) power station. The increase amounts to 5 per cent. for nine senior engineers and 2½ per cent. for the first-class junior engineers. Increases of 7½ per cent. and 5 per cent. had been claimed.

It was stated that recently two men displaced as a result of the operation of the Electricity (Supply) Acts had been found other positions through the Displacement Register. The joint secretaries of the Board considered that the value of the Register was not sufficiently appreciated.

The question of holidays was raised. The staff side proposed (a) that expenses incurred by men recalled from holidays should be borne by their undertakings; (b) that unless holidays could be granted at the mutual convenience of the undertakings and the employees, the latter should receive pay in lieu; and (3) that owing to the emergency the holiday period (normally May to September) should be extended to March 31st, 1940. The employers considered that matters (a) and (b) were for the individual undertakings to decide, but approved the suggested extension of the holiday period.

The formation of a District Joint Board for Northern Ireland was approved.

COMMERCIAL and INDUSTRIAL NEWS

Priority and Controls. Canadian Import Licences. New Bristol Premises. Emergency Transformers for the C.E.B. Finchley Showrooms Black-out Scheme

Service Cables at Southport

RECENTLY the Southport Chamber of Trade complained to the Town Council that many members of the local Electrical Contractors' Association had properties already wired, but were unable to complete the installations because of the restrictions on service cable laying by the Electricity Department. It was also pointed out that complete stagnation was caused because contractors could not obtain new work through being unable to promise an electricity supply. The Corporation has now received sanction from the Electricity Commissioners to lay service cables on premises already wired or in course of wiring. The borough electrical engineer interviewed the Electricity Commissioners who stated that the Department could complete the orders on its books, but that any further applications received would have to be submitted to the Commissioners before service cables could be laid.

A.R.P. Lighting for Garages

The Lighting Service Bureau has distributed a leaflet to 12,000 garages in which it emphasises the necessity for adequate lighting for night work, and draws attention to the recommendations of Government Departments that normal lighting should be maintained inside, and the building blacked out. The Bureau has two booklets available for garage proprietors entitled "Lighting for Production" and "Profits from Shop Lighting," dealing with the lighting of

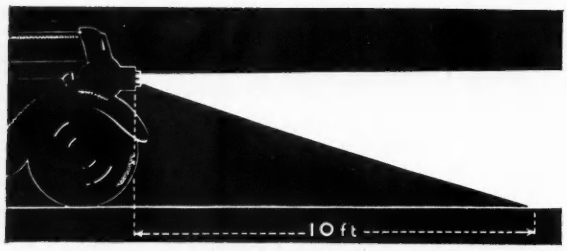


Diagram showing the correct method of lighting for road vehicles

industrial and commercial premises. Details of the construction of light-locks or traps for entrances are given in B.S.S. B.S./A.R.P. 15, entitled "Light-locks for Shop Entrances," and the leaflet includes diagrams of typical light-locks. The principal points from a pamphlet issued by the Ministry of Home Security are also given together with a diagram showing the way in which lights on road vehicles must be dealt with so as to comply with wartime lighting restrictions.

Aluminium Control

The Minister of Supply has made an Order (the Control of Aluminium (No. 4) Order, 1939) under Regulations 55 and 98 of the Defence Regulations, 1939, which came into force on November 24th. This Order revokes the Control of Aluminium (No. 3) Order, 1939, but repeats its main provisions, *e.g.*, a licence is required for the purchase, sale or use of unwrought aluminium or aluminium alloys. The importance of the new Order lies in the fact that under it the Ministry of Supply becomes the sole seller of virgin aluminium. No maximum price is, therefore, necessary in the Order, but the Ministry has decided to sell aluminium in notch bar or ingot form until further notice at £110 per ton delivered into consumers' works with extras for other forms and purities. The maximum prices previously in force for aluminium alloys, virgin or secondary, and for scrap have been withdrawn and no maximum prices are scheduled in the new Order. It is anticipated that they will find a reasonable level by reference to the new virgin ingot price. The price situation of these materials will, however, be closely watched over. Powers are taken to impose maximum prices at any time by Direction. All inquiries should be addressed to the Aluminium Control, Raven Hotel, Shrewsbury.

Priority and Controls

At a Press conference last week, Col. J. J. Llewellin, M.P., Parliamentary Secretary to the Ministry of Supply, made a statement on the subject of priority and controls. He commenced by outlining the structure of the Central Priority Department, presided over by Lord Chatfield, which functioned through five sub-committees dealing with labour; transport; works and buildings; raw materials; and productive industry. He, Col. Llewellin, was concerned particularly with the last two, and he pointed out that so far no priority certificates had been issued. They had refrained from issuing certificates mainly lest they should interfere with production for export which was of the first importance in helping to pay for supplies from overseas. The speaker referred to the confusion caused during the last war by the issue of too many priority certificates by several departments.

Manufacturers had been told the position through statements in Parliament and in the public Press but still paid no attention, and so it had been necessary to send 50,000 letters to industrialists emphasising the fact that they could carry on with their ordinary business. Surveys were made by the Department, and it was the aim to give orders to as many firms as possible and see that productive capacity was ahead of the orders placed.

Certificates of priority in respect of raw materials would only be necessary where there might be a definite shortage, and to meet this contingency controllers of materials had been appointed. The system simplified the settlement of priority questions, and the controllers were operating it on commonsense lines. The requirements of the various Departments and the stocks available were studied and allocation made without the necessity for priority certificates.

Col. Llewellin said that there had been criticisms of the controllers on several grounds which he dealt with *seriatim* to show that they were generally unjustified. In reply to the accusation that control had raised prices, he said that the average increase had been only 10 per cent. Prices were bound to rise; it was the aim of the controllers to keep that rise within bounds, and to make it a gradual one.

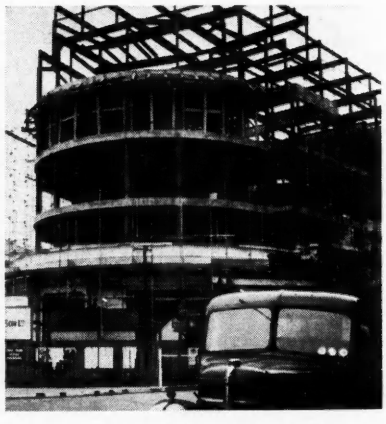
Dealing with non-ferrous metals, he said that there were adequate supplies of copper and lead, although aluminium was short owing to the enormous requirements for aircraft. As to zinc, the shortage of torch batteries was not due to lack of that metal, but to the very heavy demand from the Services and the public.

Canadian Import Licences

The *Board of Trade Journal* says that certain United Kingdom manufacturers have refused to accept orders for shipment to Canada or to ship goods already on order until they were sure that their customers had obtained import licences to permit the entry into Canada of such goods. In taking this action they were presumably under the impression that the Canadian Government was proposing to restrict imports from the United Kingdom and elsewhere. Inquiries made by H.M. Senior Trade Commissioner in Canada have shown that it is not the present intention of the Canadian authorities in any way to restrict imports, and the sole purpose of the regulation requiring importers to take out import licences is to substantiate, for the requirements of the Foreign Exchange Control Board, the necessary purchases of foreign exchange. These licences, in fact, might better be named "Certificates of Import." So far from it being necessary for Canadian purchasers to secure import licences at the time of ordering the goods, the issue of licences in advance of the arrival of the goods is specifically forbidden by the Board. It is thus clear that United Kingdom manufacturers can continue to solicit business in Canada without any fear of their customers being unable to obtain import licences.

Bristol's New Electricity Offices

When the scheme for the erection of new central premises for the Bristol Corporation Electricity Department was first put in hand there was no threat of war, but despite the changed conditions the need for such a building remains, and work is continuing on the erection of the premises, which will cost £250,000. The war may have an adverse effect upon the sales of electricity undertakings, but it is necessary to be prepared to meet the demands which will arise when normal peacetime conditions are restored, and Bristol Electricity Department is proceeding with its scheme with an eye to the future.



New premises of Bristol Electricity Department, work on which is still in progress

Order Your Copy

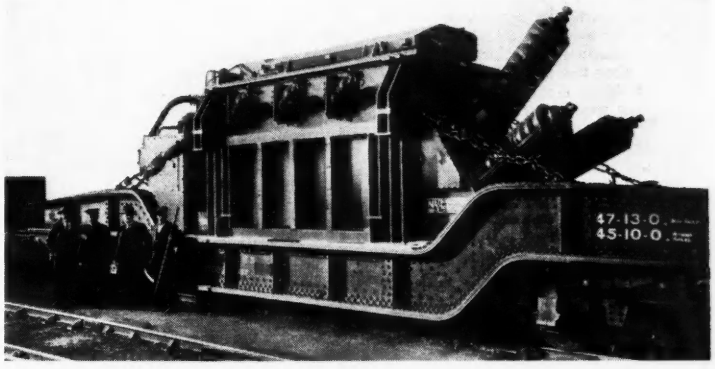
Although it is still possible to purchase copies of the ELECTRICAL REVIEW from newsagents or bookstalls, readers should make sure of receiving the journal regularly by placing an order. This will help to conserve paper by limiting the excess number of copies which always have to be printed; it will also assist the harassed newsagent and at the same time prevent disappointment to the reader himself. An order is not, of course, a long-term contract; it can be countermanded at any time.

Mobile Emergency Transformers

One of five 30,000-kVA, 132/33-kV three-phase mobile transformers ordered by the Central Electricity Board from the Metropolitan-Vickers Electrical Co., Ltd., for use as emergency standby or to deal with abnormal increases in local loads is shown in the accompanying photograph. They are said to have the highest rating for which mobile transformers have been built in Great Britain.

Each unit, complete with accessories and oil (total weight 73 tons), is ready for immediate connection after transport, either by rail or road, from the storage depôt to any site. Cooling by forced oil circulation with air blast is employed, with twin coolers (Serck Radiator Co.) shaped to the contour of the side girders. Fans and glandless oil pumps are mounted on the top of the cooler.

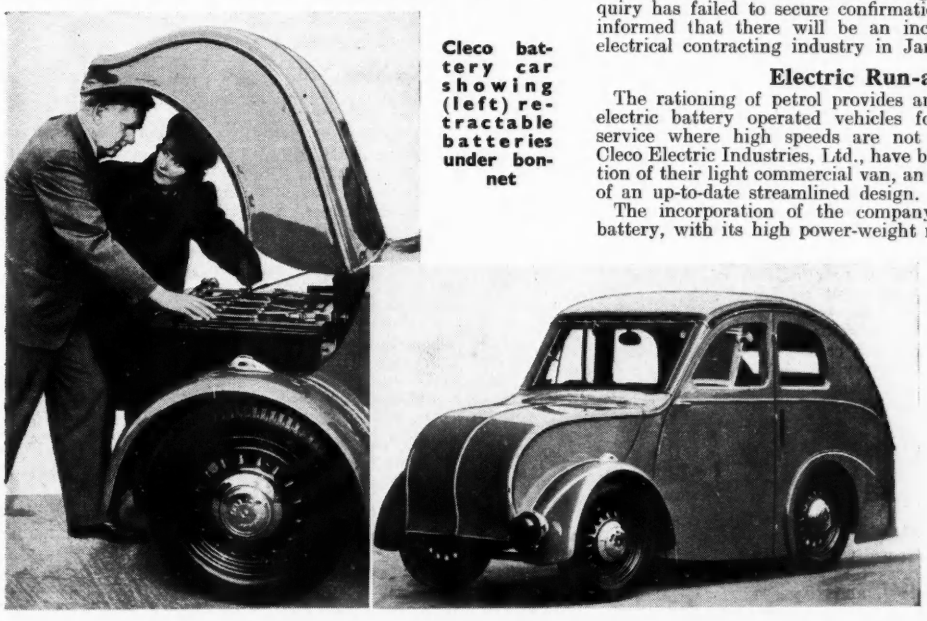
The flat rectangular oil conservator, shaped to the contour of the top of the loading gauge, can be raised for fitting a Buchholz (gas-bubble) protective device if required. The 132-kV terminal bushings are mounted at the end of the tank and the 33-kV bushings are set at an angle near the top of its side. All terminal bushings, being in pockets, can be replaced without draining oil from the main tank. The bushings (Micanite & Insulators Co.) are of the condenser type with solid filling inside the porcelain rain sheds. External off-load hand-operated tapping switches give ±2.86 and ±7.15 per cent. adjustments on the high-voltage side. A 30-kVA auxiliary transformer in a separate chamber, connected directly to the 33-kV terminals through oil-submerged bushings, is connected on its 400-V side to fuses in a chamber mounted alongside for supplying the oil pump and fan motors and for lighting and other services on site.



Met-Vick 30,000-kVA, 132/33-kV three-phase mobile transformer for the C.E.B.

Operating Theatre Lighting

In Mr. R. F. Twentyman's article on the electrical equipment at Westminster Hospital, published in our issue of November 17th, reference was made to Holophane lighting equipment in the operating theatres. The company has now sent us a special series of data sheets which are designed to act as a guide for those who are dealing with operating theatre lighting.



Cleco battery car showing (left) retractable batteries under bonnet

Practical Electrician's Pocket Book

Effects of the I.E.E. Eleventh Edition on installation testing and earth leakage trips are explained, and the regulations themselves summarised, in the 42nd edition of "The Practical Electrician's Pocket Book, 1940," just published by *Electrical Trading*, 92, Long Acre, London, W.C.2, at 2s. 10d. post free.

A new section is on "Lifts and their Maintenance," contributed by Mr. H. Marryat, while another new feature is a list of books which can be used in further study of the many subjects discussed throughout the book. The list of supply voltages in the United Kinghom has been completely revised.

National Lamp Compaign

The first advertisement appeared this week in a big new scheme which is being undertaken for "Osram" lamps. The scheme is a very comprehensive one, spread over several weeks, covering all the London national and evening papers, sixty of the most influential provincial papers, home magazines, over thirty trade papers, as well as motoring journals. Altogether nearly one thousand large insertions will be used to make the public "light-conscious." Hasty black-out arrangements tended to lower the standard of home, office and factory lighting, and although the relaxation of rationing has effected some improvement, in a great many instances the interior lighting has been left in its condition of insufficiency. Apart from the G.E.C.'s wish to do everything possible at the present time to stimulate business, this advertising campaign will impress upon the public the advisability of having the right amount of interior lighting. This will be done by emphasising the cheerfulness of good lighting, as an antidote to boredom and eyestrain, and its effect in the home, as well as in factories.

Further Increase for Electricians

Last week the *Daily Herald* reported that by an agreement reached on November 22nd between the E.T.U. and N.F.E.A. "nearly 40,000 workers in the electrical contracting industry will receive an increase of 5d. a week for every one point increase in the official cost-of-living index." Although inquiry has failed to secure confirmation of the details we are informed that there will be an increase in wages in the electrical contracting industry in January.

Electric Run-about

The rationing of petrol provides an argument in favour of electric battery operated vehicles for short range private service where high speeds are not required. Accordingly Cleco Electric Industries, Ltd., have brought out, as an adaptation of their light commercial van, an attractive little runabout of an up-to-date streamlined design.

The incorporation of the company's lightweight lead-acid battery, with its high power-weight ratio and its capacity for sustaining voltage on heavy discharge, gives the vehicle a range of approximately 50-60 miles on a single charge when the battery is discharged in short periods over eight to ten hours. The daily range can, of course, be considerably increased by plugging into the mains whenever possible or by having a spare set of batteries which can be easily substituted.

A patent mercury control system makes driving remarkably simple. The economical speeds— 14, 24 and 30 MPH—are preselected by a hand lever and it is impossible to run the car at intermediate speeds for more than 1 or 2 seconds. A special low speed of up to 3 MPH is available for manœuvring in confined spaces. Depreciation and maintenance costs are likely to be exceedingly low and with power at ½d. per kWh the cost of electricity works out at approximately 6d. per 25 miles. There are no restrictions on the use of electricity for battery charging. Tax is £4 10s. per annum and extremely low insurance rates apply to electric vehicles. While the car has great possibilities in the taxi field it is equally suitable for travellers, doctors, business men, &c. A tender for fourteen of these cars has just been accepted by the Johannesburg Electricity Department.

Claim for Installation Work

At the Halesworth (Suffolk) County Court last week the East Anglian Electric Supply Co., Ltd., sued H. Palfrey, builder, Southwold, to recover £97 in respect of electrical installations carried out in three houses. The defendant denied that he had given a direct order for the work, and said that the charges were excessive. A solicitor for the plaintiffs said that the houses were built by the defendant and taken over by employees of the company. When accounts for the installations were sent to the defendant he passed them on to the occupants of the houses who, however, repudiated liability. The wiring was done on a time and material basis, less 10 per cent. in consideration of the fact that the defendant was a builder.

Mr. C. W. Langmaid, resident manager for the company at Halesworth, said that the defendant requested him to have his house wired in accordance with his requirements and never made any suggestion that he (witness) should pay the cost. He denied that there was any schedule or specification, and said that the defendant had suggested that the three dwellings should be electric show houses; that was why the installation was more extensive than usual. Similar evidence was given by the occupants of the other houses, Messrs. C. Waters, area sales engineer, and R. B. Cook, outside representative.

The defendant, who said that he had never received details of the claim, said that the occupants had exceeded their instructions. No six-roomed cottage was ever wired at such a charge to the builder. He had had two similar houses wired by the company for a total of £34. It was suggested in the first place that there would be a saving in building costs, but he had had to add fireplaces and chimneys.

The Judge considered that the defendant either gave the tenants a free hand or agreed in terms to that which they wanted. There was nothing, in his opinion, unreasonable or unauthorised. He therefore gave judgment for the amount claimed, with costs, and on the application of plaintiffs' solicitor granted them leave to proceed by execution, the order to be suspended while the defendant paid the amount of the claim and costs at the rate of £10 per month.

Modern Shoemaking

With reference to the description of the electrical installation in the boot and shoe factory of John White (Impregnable Boots), Ltd., which was published in our last week's issue, Callender's Cable & Construction Co., Ltd., inform us that all the cables used, including both paper-insulated mains and v.i.r. were of their manufacture.

Compulsory Wiring Regulations

The *Electrical Supervisor* for November states that the National Committee on Statutory Wiring Regulations and Registration has decided to suspend its operations for the time being, and no further meetings will be held until conditions are more favourable. It will be remembered that the Committee arose out of an investigation by the Association of Supervising Electrical Engineers into the practice of a number of Dominions and foreign countries in the matter of control of installation work.

Vehicle Lighting

Last week we referred to the interim report on the illumination of public service vehicles, mentioning that copies could be obtained from the Public Service Transport Association. It does not appear to be generally known that this is the name of the former Tramways, Light Railways and Transport Association. The address is Windyridge, Epsom Lane, Epsom.

Ships' Electrical Equipment

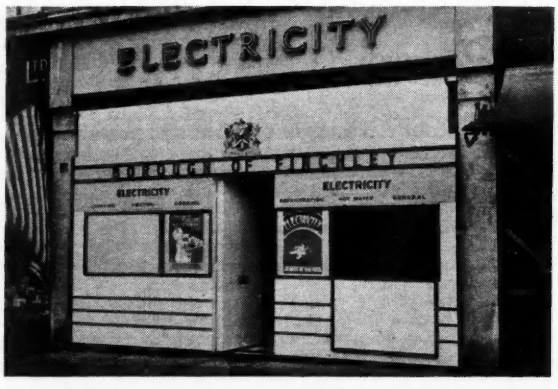
The recent appearance of a new edition of the I.E.E. regulations for electrical equipment on board ship and the revision of Lloyds' rules make the publication of a new catalogue of electrical equipment for ships by the General Electric Co., Ltd., most opportune. This catalogue is profusely illustrated, and appears to cover every marine application of electricity, apart from propulsion equipment and motors, which, however, are briefly touched upon in the opening pages. Telephone installations are also given brief treatment. Cables, fuse-gear, switchgear, instruments, bells, fire alarms, fans, galley and pantry equipment, heating methods, lamps, tools, and all kinds of accessories are dealt with in the 340 pages, which include a good index.

Finchley Black-out Scheme

If electricity undertakings are to reap the full benefit from their showrooms it is obvious that adequate lighting of the premises at night is essential, and there is no reason, even under existing conditions, why pre-war illumination should be curtailed, providing suitable steps are taken to black-out the premises effectively. Finchley Corporation Electricity Department has adopted a scheme which, in addition to permitting full use of interior lighting, also presents a pleasing exterior.

The Department has two showrooms situated at High Road, North Finchley, and Market Place, Hampstead Garden Suburb. Both are converted premises and are of similar design, each being equipped with a demonstration platform making it possible to give demonstrations by merely clearing the centre of the showroom. The frontage in each case is approximately 18 ft. and there are two showcases 5 ft. square on the pavement side of the entrance lobby. At the rear of the lobby a non-reflecting window is fitted and it will be appreciated from these details that considerable difficulty would be experienced in complying with the black-out regulations.

It was therefore decided to install a wooden hoarding across



Attractive black-out scheme adopted at the showrooms of Finchley Electricity Department

the entire frontage and fit hinged flaps in front of each showcase. When these are opened during the daytime the interior of the showcases is clearly visible, but at night when the flaps are closed the whole of the lobby may be fully illuminated, and for the purpose of shielding the light from the centre doorway a suitable light trap is provided.

The hoarding is tastefully decorated with enamel paint, the main background being blue and cream with red lettering and red edging to the flaps and frames. The three horizontal lines on the bottom are painted black. The specification for the woodwork was prepared by E.D.A. and the work was carried out by Hanson, Ltd.

Prices of Materials

No change in the prices of materials was reported on November 29th by Henry Gardner & Co., Ltd. (copper bars, best selected, sheet and rod, English pig lead and English block tin), Edward Till & Co., (india-rubber, Para fine), and F. Smith & Co. (electrolytic copper bars, wire rods and h.c. wire).

New Catalogues and Lists

Thorn Electrical Industries, Ltd., 105-109, Judd Street, London, W.C.1.—A 24-page general catalogue, produced in full colours, covering the complete range of "Atlas" lamps—general purpose and coiled-coil, decorative, traction, heavy duty, architectural, &c. A folder, entitled "Seeing is Believing," shows at a glance the many colourful sales aids available for dealers.

Morphy-Richards, Ltd., St. Mary Cray, Kent.—A leaflet describing the company's new electric poker.

English Electric Co., Ltd., Stafford.—An illustrated leaflet describing the type "NS" distribution fuse-boards.

Johnson, Matthey & Co., Ltd., 73-82, Hatton Garden, London, E.C.1.—Publication No. 47 giving practical hints on the use and maintenance of platinum laboratory apparatus.

British Insulated Cables, Ltd., Prescot, Lancs.—Leaflet P.F.351 dealing with jacketed compound carriers.

Howard Graham, Ltd., Tiddington Road, Stratford-on-Avon.—A brochure illustrating and describing the "Harris" patent flexible bearings and shackle assemblies.

A. C. Cossor, Ltd., Cossor House, Highbury Grove, London, N.5.—Leaflets relating to a new junior model vacuum cleaner, model 808, and a black-out torch, model 810.

Veritys, Ltd., Aston, Birmingham.—List No. 1169 with reference to "Maxlume" lighting equipment for electric-discharge lamps.

British Thermostat Co., Ltd., Sunbury-on-Thames.—Publication No. 340B on "Teddington" pressure controls for steam, water, air or gas.

Drake & Gorham Wholesale, Ltd., 77, Long Acre, London, W.C.2.—Catalogue No. 601 dealing with electric clocks.

Glenfield & Kennedy, Ltd., Kilmarnock.—Pamphlets relating to the Glenfield method of rapidly repairing water mains and to fighting appliances.

Information Department

GENERAL inquiries from readers relating to sources of electrical goods, makers' addresses, &c., are replied to by our Information Department through the post. Inquiries should be accompanied by a stamped addressed envelope.

Our extensive records enable us to reply to most queries, but occasionally we ask for our readers' assistance in tracing names and addresses not known to us. We should be glad to have such information regarding the following:—

G.B.M. tube benders.

EMPIRE torch.

PRESS-RITE electric presser.

ELECTRICITY SUPPLY

More "All-electric" Homes in Cardiff. Higher Central London Charges. Glasgow's Modified Lighting Scheme. Electric Cooking in Switzerland

Cardiff.—RAPID DOMESTIC DEVELOPMENT.—One of the largest increases in the domestic use of electricity during 1938-39 was that recorded by the Cardiff undertaking. In his annual report Mr. E. Jones, city electrical engineer and manager, reveals that under the "all in" tariff sales rose by 68 per cent.—from 12.3 million to 20.7 million kWh. There was a net increase of 3,661 cookers fixed, the total on circuit at the end of March being 11,351, wash-boilers connected increased from 629 to 3,018 and water-heaters from 1,692 to 2,820. Mr. Jones remarks that the maintenance of an efficient staff to deal with emergency calls is becoming a heavy responsibility, particularly in view of the increasing number of all-electric homes, but the success of the undertaking depends largely on satisfied consumers. Total sales in the distribution area were 145.6 million kWh, an increase of 11 per cent. Financially, there was a deficit of £7,504 compared with a profit of £56,044 in the previous year. Expenditure on wiring for hire schemes was a considerable item, but it is pointed out that while being charged to one year's working this provides means for increased consumption of electricity for many years to come. Also, price reductions equivalent to £37,000 per annum were made in 1937. The present high cost of production is, however, likely to make an upward revision of tariffs necessary.

Croydon.—SHOWROOMS TO BE COMPLETED.—The Electricity Committee has decided to complete the new electricity offices and showrooms.

SUB-STATION EQUIPMENT.—Plant at the Croydon Factory Estate sub-station is to be increased at a cost of £1,432. A site has also been purchased by the Council at Hartland Way, Addington, for a new 6,000-V sub-station.

Dumfries.—REVISION OF HIRE CHARGES.—The Town Council has approved a recommendation of the Electricity Committee for the revision of charges under the new agreements for the hire of domestic appliances consequent upon the increased cost of such appliances. It is proposed to adopt a radiant type of cooker hot plate.

Dundee.—CENTRAL CONTROL SYSTEM.—On November 21st the Lighting Committee approved a scheme prepared by Mr. T. M. Lappin, lighting engineer, for the central control of street lighting. The scheme, providing for electric lighting to be controlled from three switch-points, is estimated to cost about £1,000. Mr. Lappin said that if the Home Office did permit a modified form of street lighting it would insist that lighting must be extinguished immediately on receipt of an air-raid warning. That could not be done at present in Dundee.

Eccles.—LOAN RESTRICTION.—The Electricity Committee reports that the Electricity Commissioners are not prepared to give their consent to a loan of £15,000 for unspecified expenditure on consumers' appliances for hire in the absence of further information as to the essential needs of the undertaking, but would be prepared to sanction an amount estimated to be sufficient in the light of present restrictions for a period up to September, 1940.

Edinburgh.—LIGHTING EXPERIMENTS.—Members of the City Council and Corporation officials recently witnessed various stair lighting experiments. The party also saw an experiment in which a kerb treated with fluorescent paint became sharply outlined under the influence of ultra-violet rays from a lamp fixed to an electric light standard. It was pointed out that this was an expensive process and was very unlikely to be adopted by the Corporation.

Eston.—AIR-RAID SHELTER LIGHTING.—Auxiliary electric lighting is to be installed in public air-raid shelters at an estimated cost of £199.

Fleetwood.—HIGHER CHARGES.—On November 22nd the Council decided to increase the price of electricity by 7½ per cent. from the December meter readings. The tariff was advanced by 2½ per cent. a year ago.

Glasgow.—MODIFIED LIGHTING.—Experiments with a modified system of street lighting are to be carried out. The system has been devised by the Corporation Lighting Committee, and the experiments will be confined to Bothwell Street where they will be inspected by Home Office officials, representatives of the Scottish Office, and police and Corporation officials. Bailie R. Y. Gemmell, convener of the Lighting Committee, said that the only effective way to challenge the policy of complete black-out was to confront the authorities with an example of an alternative which the Lighting Committee regarded as desirable for public convenience and at the same time not conducive to air-raid danger. If the inspecting authorities were satisfied that the scheme was permissible similar lighting would be extended to other main streets.

Guisborough (Yorks).—PRICE INCREASES.—The Urban District Council has increased the charges for power and lighting by ½d. per kWh. The electrical engineer (Mr. J. I. T. Normington) in a report to the Council stated that the step was necessary to prevent a deficiency on the working of the undertaking.

Hastings.—EXTENSIONS.—The Town Council is to apply for sanction to borrow £10,000 for prospective expenditure on house services. It is also proceeding with a revised scheme for mains extensions at an estimated cost of £7,910.

London.—CENTRAL LONDON CHARGES.—Last week Central London Electricity, Ltd., announced that revised charges would become effective as from the Christmas meter readings. In the eastern part of the area the maximum flat rate of 3¼d. per kWh will be raised to 4½d. and in the western area from 4½d. to 6d. For heating and power the charges will be increased to 1¾d. per kWh where they are at present less than this amount. There will be a revised scale of domestic and commercial two-part tariff fixed charges, plus ¾d. per kWh for all consumption. Except on the two-part tariff the 7½ per cent. addition to accounts instituted early in the year is being withdrawn. Flat-rates are not to be increased in the case of artisans' dwellings on the Westminister estate and in parts of Pimlico.

POPLAR.—In view of increased coal prices and the heavy loss of revenue the Poplar Electricity Committee reports that it is now imperative to raise the power tariffs except in cases where a coal clause applies. An increase of 10 per cent is proposed.

STOKE NEWINGTON.—The Electricity Committee is seeking sanction to borrow £5,000 for domestic apparatus.

Since the outbreak of war the affairs of the electricity undertaking, together with other activities of the Corporation, have been conducted by the Emergency Committee, but the monthly meetings of the Electricity Committee are now being resumed.

WESTMINSTER.—In a letter to the Under-Secretary of State, Home Office, the Emergency Committee of the City Council states that it has received a report from the city engineer of the official trial at Liverpool of a modified system of street lighting. The results of the trial have led the Committee to believe that it would be practicable to devise a system of modified street lighting for London, but it feels that the Government might desire further trials to be carried out on an extensive scale before any relaxation of the present restrictions could be authorised and offers to co-operate in a trial on a large scale in Westminster.

Manchester.—LIGHTING EXPERIMENTS TO CONTINUE.—Last week Sir R. Noton Barclay, chairman of the Emergency Committee, said that a system of modified street lighting had not yet been devised which they could submit to the Home Office, but they would continue their experiments.

Scarborough.—SWITCHGEAR ALTERATIONS.—Following consideration of a report by the borough electrical engineer the Town Council has decided to apply to the Electricity Commissioners for sanction to borrow £9,632 for alterations and additions to the 11-kV switchgear at the generating station. During a long discussion on the proposal Councillor Scrimminger (chairman, Electricity Committee) recalled that serious fires had occurred in electricity undertakings during the last two years and it was to avoid anything of this sort and protect employees that he asked for the recommendation to be approved.

Wigton.—CONVERSION OF PUMPING PLANT.—The Rural District Council has decided to apply to the Ministry of Health for sanction to borrow £490 for converting the oil-engine driven pump at the Greenrow sewage pumping station to electric drive.

Willingham (Lincs).—SUPPLY INAUGURATED.—A supply of electricity was switched on in the village last week.

York.—EXTENSION POSTPONED.—The City Council has postponed its application for permission to borrow £945 for providing a supply of electricity to Upper and Lower Dunsforth and Branton.

Overseas

Australia.—REFRIGERATOR HIRE-PURCHASE SCHEME.—The Sydney County Council, which controls most of Sydney's electricity supply and provides much of the electrical equipment used by householders on remarkably small weekly payments, recently approved the supplying of refrigerators to the public on a no-deposit basis with terms spread over five years. Our Australian Correspondent states that the move was sponsored to overcome some of the competition which has been felt from the gas industry. It has been agreed to review the position at the end of six months to determine whether subsequent sales should be restricted to Australian-made equipment.

USE OF LOW-CALORIFIC-VALUE FUEL.—Speaking at a joint meeting of the Perth division of the Institution of Engineers of Australia, and the West Australian branch of the Institution of Electrical Engineers recently, Mr. H. W. Taylor (general manager of the Western Australia Government Tramways and Electricity Supply Department) referred to the suc-

cess that had attended the use of Collie coal (calorific value approximately 8,750 BThU per lb.) in pulverised form at the East Perth power house. He said that the thermal efficiency compared favourably with that of power stations using coal of a much higher calorific value. Mr. Taylor was reading a paper on "Electricity Supply in Western Australia." He said that there were 97 power stations in the State; output had increased by about 8 per cent. each year, and it was likely that this expansion would be exceeded in the future. It was Mr. Taylor who pioneered the use of "Collie" coal.

Bulgaria.—PROPOSED STATE MONOPOLY.—It is reported that a project for a State monopoly of the sale of electricity is under consideration. The proposal is that private enterprises should continue to construct and operate central stations, but should sell all the energy generated to the State, which would thus become the sole distributing agency. A scale of charges would be fixed low enough to encourage the domestic use of electricity, which, it is thought, would have a stimulating effect upon the Bulgarian electrical manufacturing industry. The plan provides for the modernisation and extension of existing power stations.

Brazil.—CAPACITY OF POWER PLANT.—The Brazilian Directorate of Economic and Financial Statistics has recently issued a report on the position of the electricity supply industry at the end of 1937. At that date the power plants in the country had a total capacity of 834,000 kW of which hydro-electric systems were responsible for 693,600 kW, or over 83 per cent. It is estimated that only about 5 per cent. of the water power resources of Brazil is at present being utilised.

Canada.—FLOODLIGHTING TO AVOID SABOTAGE.—While England is "blacking out," Canada is increasing illumination as a wartime protective measure, the Illuminating Engineering Society, Toronto Section, was informed at a recent meeting. In Canada floodlighting of buildings, power plants and similar institutions that might be subject to sabotage is a recognised protective measure, it was stated.

POWER CONTROL IN ONTARIO.—Under the Power Control Act, 1939, recently passed at a special session of the Ontario Legislature the Hydro-Electric Power Commission of Ontario is given control for the duration of the war of the generation, transformation, transmission, distribution, supply and use of all power in the Province. The object is to give the Commission authority to restrict, prohibit and apportion the supply of power in order to effect the most economical, efficient and equitable use and distribution of power. During the 1914-1918 war Ontario experienced a shortage of power but Dr. T. H. Hogg, chairman of the Commission, emphasises that a repetition of these conditions is unlikely.

India.—COMPANIES' INCREASED SALES.—Mr. J. R. D. Tata, presiding at the recent annual meetings of the Tata Hydro-electric Power Supply Co., Ltd., and the Andhra Valley Power Supply Co., Ltd., covering the year ended June 30th last, reported that the sales of the former had increased from 130.0 million to 133.3 million kWh while those of the latter had risen from 180.0 million to 184.9 million kWh.

Italy.—INCREASED PRODUCTION.—While during 1938 the output of electricity advanced by only 1.3 per cent. over the preceding year, official figures just published by *L'Energia Elettrica* show that the progress in production in the first half of this year has averaged 13.5 per cent. During the six months the output amounted to 8,126.6 million kWh (7,628.0 million from water power) as against 7,162.3 million kWh in the corresponding half of 1938.

New Zealand.—DEVELOPMENT.—Figures relating to the generation and supply of electricity in 1938-39 just published show that there were increases over the previous twelve months of 18,737 in the number of retail consumers; 14,772 (23 per cent.) in the number of ranges; 14,692 (19 per cent.) in water-heaters; and 2,263 (10 per cent.) in milking machines. Not only has the number of consumers been increasing but the average kWh sold per consumer continues to show an upward tendency.

Palestine.—RISING OUTPUT.—For the first time in Palestine history monthly electricity consumption has reached 10 million kWh. According to official figures, the August sales of the Jerusalem Electric and Public Service Corporation and the Palestine Electric Corporation totalled 10,610,000 kWh, an increase of over 1¼ million kWh in comparison with August of last year.

Rhodesia.—HYDRO-ELECTRIC SCHEME.—It is reported that orders have been given for the immediate commencement of work in connection with the installation of auxiliary power plant near the Lunsenfwa Falls.

Switzerland.—EXTENT OF ELECTRIC COOKING.—Of 9,200 dwellings built during 1937-38 34 per cent. were provided with all-electric kitchen equipment, states our Geneva Correspondent. In two of the larger towns the proportion was over 60 per cent. In the Canton of Zurich 39 localities now have between 51 and 79 per cent. of the kitchens electrically equipped, in four communities the proportion ranges from 80 to 96 per cent. and in one electric cooking is employed in all the houses.

United States.—NIAGARA HUDSON GENERATING STATION.—The generating station under construction by the Central New York Power Corporation is to be immediately doubled in size, reports *Reuter's Trade Service*, from Oswego. The two 80,000-kW units are expected to produce one kWh per 0.85 lb. of coal burned.

TRACTION

L.M.S. Railway.—LIGHTING IN SUBURBAN TRAINS.—Last week the company demonstrated the system of lighting which will be made general on all L.M.S. London suburban steam trains as rapidly as the supply of materials permits. The amount and type of lighting provided varies with the class and type of coach, but the general practice is to have four white shoulder-lights each of 15 W and one blue light in first-class compartments. In third-class compartments one type of coach has two white roof lights (each 15 W) and one blue centre light, while the other type has a single 60-W central roof light. In every case the white lights are screened with metal shades having matt-black interiors, throwing the light down over the seats so as to enable passengers to read in comfort, but cutting off the beams from shining directly out of the compartment door-window. The side blinds of all windows will be drawn down during hours of darkness, the edges of the windows being blacked as on main line trains. Only the top half of the door window will be blacked, however, the lower half (which does not allow light to escape) being available for passengers to note at which station a train is stopping, or for latecomers to see whether a seat is vacant.

London.—TUBE TRAIN LIGHTING.—It is reported that a system of lighting which will enable passengers to read on all "Underground" trains has been approved. There will be full lighting for tunnels, reading lamps for open sections and dim lamps for use during air raids.

Russia.—LOUDSPEAKERS FOR PEDESTRIAN CROSSINGS.—A new type of traffic light equipped with loudspeakers is to be used in the streets of Moscow, states *Reuter*. The loudspeakers will be fixed at pedestrian crossings and will advise pedestrians when to cross, to "look out" and to stop.

COMMUNICATIONS

Eire.—AUTOMATIC TELEPHONY.—The Dun Laoghaire telephone exchange area has now been converted to automatic operation, and direct dialling is possible between Dublin and Dun Laoghaire. The Department of Posts and Telegraphs announces that the change-over of the Foxrock and Blackrock systems from manual to automatic will be completed soon.

Great Britain.—CONTROL OF RADIO.—The Postmaster-General announces that, in the exercise of powers conferred on him by the Defence Regulations, 1939, he has issued Orders prohibiting, except under the authority of a Post Office permit: (a) the acquisition or supply of radio transmitters and certain other electrical apparatus which may be used as parts of such transmitters; (b) the possession of radio transmitters; and (c) their use.

RADIO RELAY APPLICATION REFUSED.—The Eccles Corporation Highways Committee has refused to allow the Little Lever Radio Relay Co., Ltd., to operate a relay service in the town.

United States.—NEW 50-KW TRANSMITTER.—Recorded speeches predicting the next twenty years' progress in religion, education, science and industry were hermetically sealed in a glass crypt as part of the dedication ceremony of a new 50-kW transmitter at the Westinghouse KDKA station at Pittsburgh, Pa., on November 4th. (The station is probably better known by the call letters of its short-wave transmitter, WPIT.) It is proposed that in 1959 the records shall be broadcast as a greeting from the past on the thirty-ninth anniversary of KDKA's pioneer broadcast of a scheduled radio programme. Homes built around electric power centres, with housework and cooking managed by remote control, and dangerous and tiresome tasks performed by electric "eyes" are among the things visualised for 1959.

Comparing Thermo-Dynamic Efficiencies

LACK of a cycle of comparison for feed heating in the superheat region and for reheating with complete internal reversibility has greatly complicated analysis of plant performance. Direct bleeding in the superheat region (unlike the same process in the saturated steam region of adiabatic expansion) is an irreversible process however small the increments of temperature, because the bled steam cannot give up its superheat and latent heat at constant temperatures without isothermal compression.

In the "Journal" of the Institution of Civil Engineers, Mr. J. F. Field suggested an easily calculated basis of comparison for the efficiency of steam turbo-generators and steam electric stations and evolved formulas which were given in our issue of March 3rd. The subsequent correspondence in later numbers of the "Journal," in which several engineers criticise the proposals from various angles, has now been published. In his reply, the author shows that the novelty of his method lies in the assumption that the process can be made completely reversible in the superheat region (as in the case of the original Rankine cycle) by the addition of elementary compressors and that, when an appropriate debit for these has been made from work done in the cycle, the net efficiency of the latter is represented by the simple formulas. He claims that these formulas remain valid for any initial and exhaust-steam conditions and reheat and feed-heating conditions.

NEW PATENTS

Electrical Specifications Recently Published

Compiled by a firm of chartered patent agents. The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (1s. *each*) *can be obtained from the Patent Office,* 25, *Southampton Buildings, London, W.C.*2.

1937

26699. "Warming electrically driven vehicles." T. Ash & Co., Ltd., and E. R. Ludlow. October 1st, 1938. (514200.)

29283. "Light-projecting system." F. C. Walter. October 27th, 1938. (514201.)

34300. "Electron multipliers and circuits therefor." G. W. Walton. December 10th, 1937. (514297.)

1938

1939. "Electrical filters and impedance-transforming networks." Marconi's Wireless Telegraph Co., Ltd., N. M. Rust and R. F. O'Neil. January 20th, 1938. (514298.)

2780. "Materials for electrical contacts." General Electric Co., Ltd., and C. J. Smithells. January 28th, 1938. (514299.)

2857. "Electric switches for alternating current circuits." G. H. Scholes & Co., Ltd., G. H. Scholes and F. J. Pearce. January 29th, 1938. (514202.)

8277. "Retractive electric switches." A. J. Rumph. March 17th, 1938. (514104.)

8396. "Television receivers." Scophony, Ltd., and A. H. Rosenthal. March 18th, 1938. (514155.)

9064. "Manufacture of electric condensers." British Insulated Cables, Ltd., F. J. Brislee, B. Welbourn, H. Higham and J. C. Quayle. March 24th, 1938. (514156.)

9718. "Suspension means for the driving motors in electric traction vehicles." C. A. Barton. April 1st, 1937. (514204.)

9731. "Snap-action electric switches." Pye, Ltd., and C. E. M. Butler. March 30th, 1938. (514163.)

9872. "Magnets for electro-magnetic instruments and meters." English Electric Co., Ltd., and G. Tilstone. March 31st, 1938. (514254.)

10107. "Fitting of electric lamps." F. W. Thorpe, Ltd., and F. W. Thorpe. April 2nd, 1938. (514301.)

11571. "Electrical networks suitable for use as inter-stage coupling networks in electron-discharge tube amplifiers." Marconi's Wireless Telegraph Co., Ltd., and N. M. Rust. April 14th, 1938. (514304.)

12469. "Regulation of electric supply circuits." Standard Telephones & Cables, Ltd., P. R. Thomas and J. Kelley. April 26th, 1938. (514167.)

12540. "Combined electric fuses and switches." Brookhirst Switchgear, Ltd., and C. Lanceley. April 27th, 1938. (514110.)

12615. "Manufacture of persulphuric acid and its salt by electrolysis." E. I. Du Pont de Nemours & Co. and K. F. Paul. April 27th, 1938. (514169.)

12643. "Magnetic deflection of the ray in cathode-ray tubes." British Thomson-Houston Co., Ltd., and D. J. Mynall. April 27th, 1938. (514170.)

12714. "Magneto generators." Bendix Aviation Corporation. April 29th, 1937. (514174.)

12722. "Electric motor - control systems." British Thomson-Houston Co., Ltd. April 28th, 1937. (514263.)

12725. "Electric lamps and the like." British Thomson-Houston Co., Ltd. April 30th, 1937. (514264.)

12745. "Electrical resistance thermometers." G. I. Woolnough, J. G. Webster, and Metropolitan Vickers Electrical Co., Ltd. April 28th, 1938. (514212.)

12751. "Automatic switches for use in telephone or like systems." Automatic Telephones & Electric Co., Ltd. May 10th, 1937. (514178.)

12754. "Radio loop-antennæ." F. J. Cleveland (Bendix Aviation Corpn.) April 28th, 1938. (514179.)

12772. "High - frequency switching arrangements." Marconi Wireless Telegraph Co., Ltd., and F. W. J. Sainsbury. April 28, 1938. (514183.)

12782. "Treatment of electro-deposited zinc coatings." E. I. Du Pont de Nemours & Co. and R. O. Hull. April 28th, 1938. (514184.)

12789. "Wireless receiving apparatus." R. Bosch Ges. April 29th, 1937. (514213.)

12810. "Cathode-ray tubes." Baird Television, Ltd., and A. K. Denisoff. April 29th, 1938. (514270.)

12811. "Television and like receivers." Baird Television, Ltd., and T. C. Nuttall. April 29th, 1938. (514271.)

12848. "Electric circuit-breakers suitable for high-voltage systems." Westinghouse Electric & Manufacturing Co. April 30th, 1937. (514217.)

12873. "Electric fuses." British Thomson-Houston Co., Ltd. April 29th, 1937. (514278.)

12904. "Automatic tuning devices." Detrola Corporation. December 11th, 1937. (514187.)

12917. "Electric water-heaters." Santon, Ltd., and H. C. Sanders. April 30th, 1938. (514218.)

13007. "Contactor switches for controlling three-phase electric current." F. Heaton. May 2nd, 1938. (514310.)

13012. "Electro-magnetic apparatus for testing the thickness of coatings upon basis material." W. H. Tait. May 2nd, 1938. (Cognate application 36882/38.) (514311.)

13038. "Methods of transforming varying electric currents." Fernseh Akt. Ges. April 30th, 1937. (514316.)

13046. "Multiplex working in communication systems." Siemens Bros. & Co., Ltd., and M. Reed. May 2nd, 1938. (514317.)

13061. "Tone-controlling impedance networks." Marconi's Wireless Telegraph Co., Ltd. April 30th, 1937. (514285.)

13062. "Visual voltage-indicators of the electron-discharge type." Marconi's Wireless Telegraph Co., Ltd. April 30th, 1937. (514318.)

13063. "Electric oscillation generators." Marconi's Wireless Telegraph Co., Ltd. April 30th, 1937. (514286.)

13064. "Multi-waveband radio receivers and the like." Marconi's Wireless Telegraph Co., Ltd. April 30th, 1937. (514319.)

13153. "Electric motor controllers." Igranic Electric Co., Ltd. May 3rd, 1937. (514330.)

13154. "Volume-control circuits for thermionic amplifiers." Philco Radio & Television Corporation. May 8th, 1937. (514331.)

13156. "Device for supporting radio coils and the like." Philco Radio & Television Corporation. May 25th, 1937. (514332.)

13174. "Electron multipliers." Baird Television, Ltd. (Fernseh Akt. Ges.) May 3rd, 1938. (Convention date not granted.) (514335.)

13205. "Control of frequency changers employing gas or vapour electric-discharge devices." Siemens-Schuckertwerke Akt. Ges. May 3rd, 1937. (Cognate applications 13206/38 and 13207/38.) (514341.)

34255. "Electric batteries." Rulag Battery Co., Ltd. December 14th, 1937. (Cognate application 34256/38.) (514136.)

35068. "Thermionic tube with slit anode." Ideal Werke Akt. Ges. für Drahtlose Telephonie. December 7th, 1937. (514141.)

1939

511. "X-ray appliances." Siemens-Reiniger-Werke Akt. Ges. March 21st, 1938. (514223.)

1219. "Arrangements for the regulation of electric supply systems." Standard Telephones & Cables, Ltd., P. R. Thomas and R. Kelly. April 26th, 1938. (Divided out of 514167.) (514294.)

2731. "Electro-magnetically operated devices, particularly relays." Soc. d'Electricité Mors and L. J. A. Le Gok. January 26th, 1939. (514228.)

3023. "Circuit arrangements comprising controlled gas- or vapour-filled discharge tubes, particularly for seam-welding apparatus." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. January 31st, 1938. (514196.)

4745. "Means for securing an electric heating-unit to a container." E. L. Francis (Zip Heaters, Ltd.). February 13th, 1939. (514231.)

11184. "Electric accumulators." Chloride Electrical Storage Co., Ltd. (G. A. Hall.) April 13th, 1939. (514245.)

13708. "Apparatus for continuously producing helical coils of wire." General Electric Co., Ltd. May 10th, 1938. (514247.)

TRADE MARK APPLICATIONS

The following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from November 22nd:—

Holgun. No. 602674. Class 7 (IV). Portable electrically driven tools for drilling, boring, grinding, buffing, burnishing, screw driving, nut running and similar purposes.—Black & Decker Manufacturing Co., Towson Heights, Maryland, U.S.A. (British representatives: McKenna & Co., 31-34, Basinghall Street, E.C.2).

Siluminite. No. 606483. Class 17 (IV). Electrical or lead insulating materials, electrical or heat insulators and parts thereof, and materials composed principally of asbestos or mica for heat resisting or electric arc resisting purposes. —Turner & Newall, Ltd., Woodland Road, Spotland, Rochdale.

Institute of Metals

DURING the war the Institute of Metals is continuing its activities, other than those of a social character. The headquarters in Grosvenor Gardens will remain open and the joint library and the information department are available to members. These facilities are found particularly valuable by those members who are engaged in the production of munitions. At such a time the services rendered by the publications of the Institute are increasingly appreciated. The *Monthly Journal* will continue to publish original papers and also abstracts. The importance of metallurgy in the conduct of a modern war hardly needs emphasis. Technical efficiency, which is so essential, calls for the most complete organisation for the collection and distribution of knowledge, which is the main function of the Institute.

FINANCIAL SECTION

New Companies. Returns of Capital. Debenture Charges. Bankruptcies and Liquidations. Reports of Electrical Companies. Dividend Announcements. Stocks and Shares

New Companies Registered

Dunning Electrical Co., Ltd.—Private company. Registered November 23rd. Capital, £1,000. Objects: To acquire the business carried on at Rutland Road Works, Hove, as Southern Ignition Co., and to carry on the business of electricians, radio and electrical engineers, experts and contractors, metal and alloy makers, &c. Permanent directors: N. R. Dunning, 1, Mount Pleasant, Bradford-on-Avon, Wilts; and H. M. Dunning, 37, Portland Road, Hove. Secretary: N. R. Dunning. Registered office: Rutland Works, 27/9, Arthur Street, Hove, Sussex.

Champion Radio Valve & Television Corporation, Ltd.—Private company. Registered November 20th. Capital, £1,000. Objects: To carry on the business of manufacturers of radio valves, electric bulbs, radio instruments, television equipment, &c. M. Bolsom, 83, Regency Lodge, Swiss Cottage, N.W., is first director.

Companies' Returns

Statements of Capital

Watliff Co., Ltd.—Capital, £15,000 in 7,000 7½ per cent. preference and 5,000 6 per cent. preference and 3,000 ordinary shares of £1. Return dated October 12th. All shares taken up. £14,880 paid on 12,000 preference and 2,880 ordinary shares. £120 considered as paid on 120 ordinary shares. Mortgages and charges: £4,500.

B. G. Suthers, Ltd.—Capital, £1,500 in £1 shares. Return dated October 10th. All shares taken up. £1,500 paid. Mortgages and charges nil.

Colston Electrical Co., Ltd.—Capital, £4,000 in £1 shares. Return dated August 10th. 2,646 shares taken up. £1,146 paid. £1,500 considered as paid. Mortgages and charges, £1,450.

Wall & Attwooll, Ltd.—Capital, £5,000 in £1 shares. Return dated September 22nd. All shares taken up. £5,000 paid. Mortgages and charges, nil.

Metcalf Electrics, Ltd.—Capital, £500 in 200 preference and 300 ordinary shares of £1. Return dated October 16th. 200 preference and 200 ordinary shares taken up. £200 paid on the preference shares. £200 considered as paid on the ordinary shares. Mortgages and charges, nil.

Mortgages and Charges

Davis Electrical & Radio Accessories, Ltd.—Debenture, charged on the company's undertaking and property, present and future, including uncalled capital, dated November 8th, 1939, to secure £400. Holder: Moshe Gevirtzman, 7, Gloucester Gardens, N.W.11.

Smallwood Electrical, Ltd.—Two mortgage debentures, charged on the company's undertaking and property, present and future, including uncalled capital, dated October 24th, 1939, each securing £100. Holders: B. J. Smallwood, 72, Warwick Avenue, Edgware, and A. Dossmar, 132, Sutherland Avenue, Maida Vale, W.9.

Dalgetti Electric, Ltd.—Capital, £500 in £1 shares. Return dated October 3rd. 150 shares taken up. £150 considered as paid. Mortgages and charges nil.

Roberne Electrical Supplies Co., Ltd.—Capital, £1,000 in £1 shares. Return dated October 4th. 530 shares taken up. £50 paid. £478 considered as paid. £2 calls unpaid. Mortgages and charges nil.

Holdsworth Electric, Ltd.—Capital, £500 in £1 shares. Return dated October 6th. All shares taken up. £500 paid. Mortgages and charges, £400.

St. Mary's (Scilly) Electricity Supply Co., Ltd.—Satisfaction in full on September 30th, 1939, of debenture dated April 19th, 1937, and registered April 22nd, 1937. (According to the register of mortgages, the debenture registered April 22nd, 1937, originally secured £5,000.)

Bill Switchgear, Ltd.—Satisfaction to the extent of £1,000 on October 31st, 1939, of charge dated January 25th, 1937, and registered August 10th, 1939. (According to the register of mortgages, the charge registered August 10th, 1939, originally secured £10,000.)

Company Liquidations

Great Eastern Electric Co., Ltd., 73, Hounsditch, E.C.—A winding up order was made against this company recently, and according to the statement of affairs which has been filed there are liabilities of £13,496 against assets estimated to realise £12,787, leaving a deficiency of £709. The issued capital is £9,050, so that there is a total deficiency of £9,759. The failure is ascribed to the decline in the turnover due to radio manufacturers' policy of supplying direct to retailers.

Bourton-on-the-Water Electric Light & Power Co., Ltd.—Meeting December 21st at the Victoria Hall, Bourton-on-the-Water, to receive an account of the winding up by the liquidator, Mr. C. V. Wilkins.

Ashton Electrical Co. (Preston), Ltd.—Meetings December 21st at 31, Lloyd Street, Manchester, to receive an account of the winding up by the liquidators, Messrs. F. E. Bendall and A. E. Attwood.

Mid-West Radio (Manufacturing) Co., Ltd.—Particulars of claims by December 15th to the liquidator, Mr. J. Mundy, 22, Queen Street, London, E.C.4.

Amalgamated Electrical & Lighting Equipment Co., Ltd.—Meetings December 29th at 9, North Street, Brighton, to receive an account of the winding up by the liquidator, Mr. L. Goldwin.

Smethwick Electric Plant Co., Ltd.—Meeting December 29th at King Edward House, New Street, Birmingham, to receive an account of the winding up by the liquidator, Mr. F. E. Bendall.

Surrey Radio Services, Ltd.—Meetings January 3rd at 185-188, High Holborn, London, W.C.2, to receive an account of the winding up by the liquidator, Mr. C. Latham.

Shields Radio Co., Ltd.—Winding up voluntarily. Liquidator, Mr. L. Milburn.

Bankruptcy Proceedings

R. S. Newman, radio dealer, 132, Keresley Road, Coventry, and lately trading at 2, Wyley Road, Coventry.—Receiving order made November 17th on debtor's own petition. Public examination December 6th at the County Hall, Coventry.

S. G. Breed, wireless dealer, 65, Stuart Street, Luton.—Public examination December 15th at the Court House, Luton.

S. Burgoyne, electrician, 1, Mill Lane, Ferrybridge Road, Pontefract.—Public examination December 14th at The Court House, Wakefield.

E. P. Hallybone, radio dealer and electrical engineer, 15, Kneesworth Street, Royston, Herts.—Last day for receiving proofs for dividend December 5th. Trustee, Mr. R. J. N. Clean, 41, Sidney Street, Cambridge, Official Receiver.

J. Bold, radio engineer, 37, Aylesbury Street, Bletchley.—Last day for receiving proofs for dividend December 5th. Trustee, Mr. T. Pollitt, 6, The Parade, Northampton, Official Receiver.

A. Lewsley (West Ewell Electrical Supplies), electrical engineer, 2, The Parade, Chessington Road, West Ewell, Surrey.—First and final dividend of 8½d. in the £, payable December 7th at 185-188, High Holborn, London, W.C.1.

W. G. Harden and **C. H. Chinery** (Harden & Chinery), electrical and mechanical engineers, 7, Barnsbury Street, Islington, London.—First and final dividend of 11d. in the £, payable at Carey Street, London, W.C.2.

Reports and Dividends

Electrical Switchgear and Associated Manufacturers, Ltd., held their annual meeting on November 23rd, when Mr. J. A. Hirst (chairman) who presided, in referring to the operating company, Brookhirst Switchgear, Ltd., said that the difficulties of obtaining a satisfactory output under the conditions which had now existed for a considerable time had, in his opinion, largely contributed to the reduced profit. The directors and management were fully alive to the importance of obtaining a substantially increased output, both in the national and their own interests. The state of the operating company's order book at the end of July and the substantial increase in the total value of orders received during the first quarter of the current financial year formed a promising aspect of that company's outlook.

Heenan & Froude, Ltd.—Presiding at the annual meeting on November 22nd Mr. A. P. Good (chairman) said that the inquiries received, orders secured, and output obtained last year each constituted a record. He believed that during the war they would be engaged mainly on the production of their own specialities rather than on general armament work, and every endeavour would be made to encourage and develop their ordinary trade, particularly in the export markets.

Yarrow & Co., Ltd., held their annual meeting on November 22nd when Sir Harold E. Yarrow, Bart. (chairman and managing director), who presided, said that the boiler department had been fully occupied, and the satisfaction that was being experienced with their boiler under service conditions was reflected in the number of orders they were receiving, both for home and export, in connection with power stations, factories, &c.

British Industrial Plastics, Ltd.—Presiding at the annual meeting on November 22nd Mr. K. M. Chance (chairman and managing director) said that the main feature of the accounts under review was the complete recovery from the slump of a year ago. Even before the outbreak of war orders came pouring in from abroad for both Beetle and Scarab moulding powders, with the result that the export business since the outbreak of war had been exceptional. The amount of Beetle powder exported during the four weeks of September was more than double that for the average four-weekly period during the forty-eight weeks before the outbreak of war, while in October it was just less than double The export of Scarab during September was nearly two-and-a-half times the average for the previous forty-eight weeks.

Crompton Parkinson, Ltd., in a preliminary statement, report a profit for the year ended September 30th of £404,903, as compared with £402,046 in the preceding year. It is proposed to pay dividends of 4 per cent. on the first preference shares and 3 per cent. on the second preference shares for the six months ended September 30th and a final dividend on the ordinary and "A" ordinary shares of 7½ per cent. actual (against 9 per cent.), making, with the interim dividend, a distribution at the rate of 15 per cent. for the year (same). It is also proposed to pay a special cash bonus of 5 per cent. (against 15 per cent.) on the ordinary and "A" ordinary shares. The gross dividends payable on the ordinary and "A" ordinary shares for 1938-39 will absorb the same total amount as in 1937-38 due to the issue in December, 1938, of a special scrip bonus of 50 per cent. All the above dividends will be paid after deduction of income tax. It is proposed to place £125,000 to general reserve and a further

(Continued on page 721.)

STOCKS AND SHARES

TUESDAY EVENING.

STOCK Exchange markets maintain a considerabe amount of steadiness. Business is tolerably well sustained. Money continues to flow into stocks and shares which give promise of capital improvement and for the purchase of which there is also justification in the progress shown in current reports.

One feature this week is a substantial rise in Home railway stocks; the Southern Railway issues have been particularly favoured. Another feature is the strength of Cable and Wireless stocks. Tube Investments has published an excellent report and the dividend, making 23¾ per cent. for the year, is repeated after making large contributions to reserves and carry-forward. The directors announce their intention of preparing the way for reconstruction after the war. The India Rubber and Telegraph Works Company has nearly doubled its previous year's net profit. Gains in International Combustion of 5s., British Insulated and Westinghouse Brake of 2s. 6d. each, and a number of smaller rises are evidence of the investor's anxiety to acquire good industrials.

Gilt-edged Strength

In launching the new savings certificates and the £5 "baby bonds," the Chancellor of the Exchequer is making his appeal first to the investor of middle means. The gilt-edged market awaits its turn. Early December, when the £30 odd millions of War Loan interest has been disbursed, is still regarded as the most likely time for a market issue. In the Chancellor's statement that this time has not yet arrived, there is some inclination to read an expectation that gilt-edged prices are bound for yet higher levels. Meanwhile, a big response to the new issues—which are outside the market's scope—is expected to lighten the load appreciably. The issues are plainly attractive in themselves, and there is general appreciation of the wisdom of saving, in order to keep prices down, and lending to assist the vigorous prosecution of the war. London Passenger Transport Board "A" and "B" stocks are again better on the week.

Home Railway Liveliness

The market in Home railway stocks has stolen the thunder in this week's market events. While the improvement is well spread over the senior and junior stocks, some of the more speculative issues show gains of a spectacular order. Southern 5 per cent. preferred ordinary, for instance, is no less than 7½ points up at 65. This is 17 points better than the year's lowest point, but still more than 10 points below the top. The same company's 5 per cent. preference, which ranks immediately before the preferred, is 4 points better at 88. Yields at the higher prices are respectively £5 13s. 8d. per cent. and £7 14s. per cent.

One reason for this bullish outburst is the intimation that the question of Government compensation for the use of the company's lines can be solved without resort to nationalisation, a possibility that had been causing qualms. Another reason is the feeling of greater optimism over the terms of the compensation when these are made known. Many people are hoping that the basis will be calculated on the profits made during 1936-37. This would correspond with one of the standard periods on which the Excess Profits Tax is to be based, and would provide for profits well above those of 1938. A third contribution to the rise in prices is the now familiar factor of shortage of stock.

Electricity Supply Difficulties

In the Central London Electricity undertaking's explanation of the necessity for raising prices to the consumer, lies the generally accepted reason for the fact that shares in the London supply companies stand at relatively lower prices than those of the leading provincial concerns. The rise in the cost of production, together with the results of evacuation and black-out, form upper and nether millstones between which the companies' financial and service obligations would be difficult of fulfilment without help from increased prices. Some measure of the difficulties is given by the company's estimate of a drop of some 150 million units in the first twelve months of the war, and by the reference to a rise in the coal bill from 14s. per ton in 1935 to 23s. 6d. in 1939.

The situation is widely appreciated, and the announcement of the increase in prices had little effect, either one way or the other, on the London group of shares, although London Associated Electrics lost a few pence to 18s. 3d. Among the provincial issues Lancashire Light and Power have reacted from 30s. to 28s, 9d., nevertheless, this company is expected to be among the most likely beneficiaries from higher industrial demands for energy. Something of a feature in this market is the absorption of preference shares. Nearly all the prices in this group have gone up during the past few days, and the buyers continue to adopt an Oliver Twist attitude.

Electricity Overseas

Vigorous recovery on the part of shares in many overseas electricity companies has been calling for frequent comment in recent weeks. So far at least as South America is concerned, the idea behind the movement is that wartime demand for metals, food, and commodities of all kinds will favour the trade and currencies of those countries that are in a position to produce and deliver the supplies at prices satisfactory to themselves. This table gives an idea of the change which a few weeks have wrought, for these and other reasons, among stocks which have long been strangers to activity or popularity :—

Stock or Share	Oct. 17th	Nov. 21st	Rise
Anglo Argentine Trams 1st Pref.	3/9	5/–	1/3
Anglo Argentine 4% Inc. Stock	5½	13	7½
Brazilian Traction	8¾	10	1¼
Rio 5% Bonds	55	70	15
Atlas Electric...	1/6	3/–	1/6
Tokyo Electric 6% Bonds	42½	62½	20
Whitehall Investments 7½% Pref.	12/6	14/–	1/6
Palestine Electric "A"	20/–	26/3	6/3
Calcutta Electric ... ... —	28/6	30/6	2/–

Equipment and Manufacture

Industrial markets in general have remained quietly firm. Would-be buyers of shares are encountering no inclination on the part of holders to sell their investments, with the result that the demand is still only partly satisfied. Company news has been generally helpful, and industrial reports are held to be promising. Among electrical equipment shares, Electric Constructions have been singled out for attention and are 1s. 9d. higher at 33s. 9d. Reyrolles, at 55s., are another good feature. Elsewhere, Tube Investments, at 85s., S. Smith deferred, at 7s. 6d., and Falk Stadelmanns, at 18s. 9d., are all 1s. 3d. to the good. A dull exception is the fall of half-a-crown in Aron Meters, now 22s. 6d. The company has decided to postpone consideration of the interim dividend.

Crompton Parkinson Dividend

Expectation was well satisfied with the declaration of a final dividend and bonus, on Crompton Parkinson ordinary shares, making 20 per cent. for the year to June last. A year ago the company paid 30 per cent. in all, and a capital bonus of 50 per cent. This last, it was given to be understood, marked the end of a long line of scrip distributions and the beginning of a new policy involving larger cash payments. This policy provides for a regular 15 per cent. dividend with —as on the present occasion—an extra cash bonus when circumstances permit. The dividend now declared is exactly equal to last year's payment, allowing for the larger capital ranking. Profits, it is disclosed in the preliminary statement, are very close to last year's figure. At 17s. 6d. the yield on the shares works out at about 5¾ per cent., taking the dividend at 20 per cent.

Cable and Wireless

After the previous week's sudden advance, Cable and Wireless issues are quieter, but prices remain strong. The ordinary stock has risen 1 to 53½. The preference has gone further ahead to 92¼, while the 4 per cent. income stock has come belatedly into line with a rise also of 3 points, to the same figure. Anticipations of active cable traffic in wartime, together with the attractive yields on the company's stocks, are considered responsible for the revival. Globe Telegraph ordinary have risen in sympathy from 26s. 3d. to 27s. 6d. Other communication stocks to show improvements are Anglo-Portuguese Telephones, at 20s., and both the Anglo-American Telegraph issues.

Brazilian Traction and Credit

A somewhat remarkable movement at the end of last week was a jump in one day of a point in the price of Brazilian Tractions. One argument maintained that the British reprisals, in answer to the indiscriminate U-boat campaign of the Germans, will lead to a cutting off from Germany of any Brazilian exports and that the effect would be to force Brazil to trade more extensively with this country. Encouragement of trade between ourselves and Brazil would enable Brazil to raise her exchange position to a more satisfactory level and thereby assist the credit of the country. Another contention, which sounds more reasonable, is that the British Government has decided to make large purchases of cotton in Brazil and to pay for these by releasing milreis against sterling. This would have the same effect as the operation mentioned in the previous paragraph, namely, the freeing of Brazilian exchange, and stimulating to the country's credit.

World Electricity Production

APPROXIMATE electricity production throughout the world last year is estimated at 460,000 million kWh in the latest report of the Electrical Industries Bank of Zurich, Switzerland. This compares with 280,000 million kWh in 1929. The largest improvement in this ten-year period has been in the United States, where production has jumped from 120,000 to 148,000 million kWh, followed by Germany whose production increased from 30,600 million kWh in 1929 to 55,200 million kWh in 1938. Production per inhabitant has also increased considerably. Switzerland leads with 1,670 kWh, followed by the United States (1,140 kWh), Germany (810 kWh) and Great Britain (690 kWh). The general consumption for the world, per inhabitant, is estimated at 140 kWh for 1929 and 210 kWh for 1938. It is emphasised that the figures per inhabitant are based on production and not consumption; thus Switzerland does not consume 1,670 kWh per inhabitant, a large part of the power produced in the country being exported.

ELECTRICAL COMPANIES' SHARES

Prices, Dividends and Yields

Company	1939 Highest	1939 Lowest	Dividend Previous	Dividend Last	Price Nov. 28	Rise or Fall	Yield p.c. £ s. d.
Home Electricity Companies							
Bournemouth and Poole	68/3	57/–	15	15	58/9	—	5 2 0
British Power and Light	30/9	21/–	7	7	26/–	—	5 7 8
City of London	33/9	23/6	7½	7½	25/–	+6d.	6 0 0
Clyde Valley	37/9	27/6	8	8	33/3	—	4 16 3
County of London	46/9	28/–	10½	10½	36/3	—	5 16 0
Edmundson's :							
7% Pref.	31/6	27/6	7	7	28/–	—	5 0 0
Ord.	27/9	18/6	9	6	24/–	+6d.	5 0 0
Elec. Dis. Yorkshire	41/6	32/6	9	9	35/9	—	5 0 5
Elec. Fin. and Securities	47/9	40/–	12½	12½	40/–	—	6 5 0
Elec. Supply Corporation	51/9	41/–	12	12	41/3	—	5 16 0
Isle of Thanet	20/–	15/–	4	4	15/–	—	5 6 8
Lancs Light and Power	34/6	25/–	7½	7½	28/9	−1/6	5 4 4
Llanelly Elec.	22/6	17/6	5½	5½	18/–	—	6 2 3
Lond. Assoc. Electric	30/–	18/3	7	7	18/3	−6d.	7 13 4
London Electric	34/3	22/6	7	7	25/–	—	5 12 0
London Power Deb. Red.	106½	98	5	5	103½	—	4 16 6
Metropolitan	51/–	35/–	12	12	37/–	—	6 9 9
Midland Counties	38/9	30/–	8	8	35/–	—	4 11 5
Mid. Elec. Power	41/9	35,–	8	9	36/3	—	4 19 4
Newcastle Elec.	28/9	26/–	7	7	26/3	—	5 6 8
North Eastern Electric :							
Ordinary	32/3	23/6	7	7	27/6	—	5 1 10
7% Pref.	32/6	27/6	7	7	30/–	+6d.	4 13 4
Northampton	48/–	41/–	10	10	42/6	—	4 15 0
Notting Hill 6% Pref. (£10)	12½	11½	6	6	11½	—	5 4 4
Northmet Power :							
Ordinary	46/6	30/6	10	10	37/6	—	5 6 8
6% Pref.	29/–	23/6	6	6	27/–	—	4 9 0
Richmond Elec.	29/–	21/6	7	7	23/9	—	5 18 0
Scottish Power	38/9	28/6	8	8	32/6	—	4 18 6
Southern Areas	22/9	17/–	5	5	18/–	—	5 11 1
South London	30/9	23/9	7	7	22/–	—	6 7 3
West Devon	23/3	18/9	5	5	18/9	—	5 6 8
West Glos	21/3	16/3	2	2½	16/3	—	3 1 6
Yorkshire Elec.	38/6	28/9	8	8	33/9	—	4 14 10
Overseas Electricity Companies							
Atlas Elec.	4/3	1/6	Nil	Nil	3/–	+6d.	—
Calcutta Elec.	39/–	25/–	10*	10*	30/6	—	—
Cawnpore Elec.	34/6	28/3	10	10	27/6	—	—
East African Power	26/3	20/–	7	7	23/–	+6d.	6 1 9
Jerusalem Elec.	24/6	21/–	7	7	21/–	—	6 13 4
Kalgoorlie (10/–)	10/6	9/–	7½	7	10/–	—	7 0 0
Madras	31/–	21/3	8*	8*	21/3	—	—
Montreal Power	35½	30	1½	1½	32½	—	—
Palestine Elec. "A"	29/6	20/–	7½*	5*	26/3	+1/6	3 16 2
Perak Hydro-electric	18/9	13/6	6	2½	18/3	—	2 14 9
Shawinigan Power	24	20	85cts.	83cts.	24	—	—
Tokyo Elec. 6%	63	37	6	6	62½	+2	9 12 0
Victoria Falls Power	73/9	60/–	12½	15	70/–	+1/6	4 5 9
Whitehall Investments Pref.	19/6	12/6	7½	7½	14/–	—	10 14 2
Public Boards							
Central Electricity :							
1950–70	112	103	5	5	106½	—	4 14 0
1955–75	115½	104½	5	5	108	+1	4 12 6
1951–73	106½	101	4	4½	104	—	4 6 3
1963–93	95½	84	3½	3½	88	—	3 19 7
London Elec. Trans. Gtd.	88½	83	2½	2½	87	—	2 17
London & Home Counties							
1955–75	107½	105	4½	4½	107	—	4 4 1
Lond. Passenger Transport :							
A	114½	103	4½	4½	107½xd.	+2½	4 4 6
B	117½	102	5	5	105½xd.	+2	4 14 9
C	83½	64½	4	1½	65	—	2 6 2
West Midland Joint Elec., 1948–68	112½	104½	5	5	106	—	4 14 4
Telegraph and Telephone							
American Tel. & Tel.	210	159	9	9	210	—	4 5 8
Anglo-Am. Tel. :							
Pref.	101½	82	6	6	91½	+2	6 11 2
Def.	23⅝	18½	1½	1½	21½	+1	6 19 6
Anglo-Portuguese	24/–	17/6	8	8	20/–	+6d.	8 0 0
Cable & Wireless :							
5½% Pref.	95½	75	4½	5½	92½	+3	5 19 0
Ord.	55	34	4	4	53½	+1	7 9 7
Income	100	87½	—	—	92½	+3	4 6 5
Canadian Marconi $1	6/–	3/9	—	Nil	5/–	−3d.	—
Globe Tel. & Tel. :							
Ord.	31/3	23/6	7½*	7½*	27/6	+1/6	5 9 1
Pref.	26/9	22/6	6	6	25/–	—	4 16 0
Great Northern Tel. (£10)	38	25	20	20	24½	—	8 3 4
Inter. Tel. & Tel.	10½	5½	Nil	Nil	6½	—	—
Marconi-Marine	30/–	23/–	7½	10	26/3	—	7 12 4
Oriental Telephone Ord.	2½	46/3	12*	12*	2⅛	—	5 4 0
Radio Corpn.	8⅝	5⅜	8	6	7⅛	—	—
Telephone Props.	14/–	12/9	5	6	13/9	—	8 14 6
Telephone Rentals (5/–)	10/–	7/–	10	10	8/–	—	6 5 0
Western Union	40⅛	19½	2½	—	35⅛	—	—
Traction and Transport							
Anglo-Arg. Trams :							
First Pref. (£5)	7/6	3/6	Nil	Nil	5/–	—	—
4% Inc.	16	5	Nil	Nil	13	—	—
British Electric Traction :							
Def. Ord.	1025	515	5	5	700	—	—
Pref. Ord.	164	130	8	8	142	—	5 12 8
Bristol Trams	52/6	36/3	8	10	42/–	—	4 15 5
Brazil Traction	13	7⅛	$1	50c.	10	+1	—
Calcutta Trams	25/6	20/9	8	8	21/3	—	7 10 6
Cape Elec. Trams	18/–	16/9	5	5	17/6xd.	+9d.	5 14 4
Lancs Transport	37/9	27/6	10	10	30/–	—	6 13 4
Mexican Light :							
1st Bonds	25	20	5	5	27½	—	—
Rio 5% Bonds	81	47	5	5	70	—	7 2 10
Southern Rly. :							
5% Prefd.	75½	48	5	5	65	+7½	7 14 0
5% Pref.	99½	79	5	5	88	+4	5 13 8
T. Tilling	2½	32/6	10	10	38/3	—	5 4 7
Tilling & B.A.	54/6	43/9	10	9*	45/–	—	4 2 3
West Riding	37/9	30/–	10	10	30/–	—	—
Equipment and Manufacturing							
Aron Electricity Ord.	32/3	22/6	15	15	26/6	−½	—
Assoc. Elec. :							
Ord.	45/3	31/3	10	10	40/–	—	5 0 0
Pref.	36/6	31/3	8	8	32/6	—	4 18 6
Automatic Telephone & El.	47/6	39/3	10	12½	42/6	—	5 17 8
Babcock & Wilcox	48/–	37/–	10	12½	40/9	+9d.	6 2 7
British Aluminium Ord.	58/9	48/9	12½	12½	51/3	+6d.	4 17 5
British Insulated Ord.	88/–	72/6	20	20	80/–	+½	5 0 0
British Thermostat (5/–)	16/–	12/–	18½	18½	12/6	—	7 8 0
British Vacuum Cleaner (5/–)	22/6	12/6	40	40	12/6	—	—
Brush Ord.	5/9	4/–	Nil	Nil	3/9	—	—
Callender's	92/–	52/6	20	15	60/–	—	5 0 0
Chloride Elec. Storage	82/3	62/6	20	15	3⅜	—	4 9 0
Consolidated Signal	96/–	75/–	36½	36½	65/–	—	9 14 8
Crabtree (10/–)	25/6	17/6	17½	17½	21/3	—	8 4 9
Crompton Parkinson :							
Ord. (5/–)	21/–	12/6	15	20	17/6	—	5 14 3
E. K. Cole (5/–)	9/–	3/–	10	Nil	4/6	—	—
Elec. & Musical Industries (10/–)	14/9	7/–	5	Nil	7/–	−3d.	8 0 0
Electric Construction	38/6	31/–	12½	13½	33/9	+1/9	7 4 5
Enfield Cable Ord.	58/6	42/6	25	16½	45/–	—	7 8 5
Electrical Switchgear (10/–)	27/–	21/–	16	10	21/3	—	4 14 3
English Electric	36/6	25/–	10	10	30/9	—	6 10 4
Ensign Lamps (5/–)	16/9	13/9	—	25	15/–	—	8 6 8
Ericsson Tel. (5/–)	43/–	35/–	25*	25*	37/6	—	3 6 8
Ever Ready (5/–)	25/–	18/–	35	30	24/6	—	6 2 5
Falk Stadelmann	27/–	17/6	10	6	18/9	+1/6	6 13 4
Ferranti Pref.	25/6	22/–	7	7	22/–	—	6 7 3
G.E.C. :							
Pref.	31/9	26/3	6½	6½	27/6xd.	+6d.	4 14 6
Ord.	82/–	61/3	17½	20	75/–	—	5 4 4
Greenwood & Batley	27/6	22/6	7	15	22/6	—	13 6 8
Hall Telephone (10/–)	22/3	18/6	15	15	18/9	—	8 0 0
Henley's (5/–)	21/–	15/–	20	20	17/6	—	5 14 3
4½% Pref.	23/–	18/9	4½	4½	18/9	—	4 16 0
Hopkinsons	46/3	37/3	12½	15	37/6	—	8 0 0
India-Rubber Pref.	21/3	18/9	5½	5½	20/–	+1/6	5 10 0
Intl. Combustion	120/–	97/–	32½	32½	5½	+½	6 3 10
J. Lucas	60/–	45/–	15	15	52/6	+1/6	5 14 3
Johnson & Phillips	41/3	32/–	12½	12½	40/–	—	6 5 0
Lancashire Dynamo	72/–	55/–	25	25	2½	—	10 0 0
Laurence Scott (5/–)	12/–	9/6	15	15	9/6	—	7 18 4
London Elec. Wire	31/6	28/6	12	7½	28/9	—	5 4 4
Mather & Platt	50/–	39/–	13½	13½	45/–	—	6 0 0
Metropolitan Elec. Cable Pf.	21/3	21/–	5½	5½	21/3	—	5 3 0
Murex	85/9	63/9	20	20	75/–	—	5 6 9
Pye Deferred (5/–)	13/9	7/6	25	25	7/6	—	16 13 4
Revo (10/–)	35/6	25/–	17½	17½	25/–	—	7 0 0
Reyrolle	61/–	52/6	12½	12½	55/–	+1/6	4 11 0
Siemens Ord.	26/9	18/9	7½	7½	20/–	—	7 10 0
Strand Elec. (5/–)	5/6	2/0	10	4	2/–	—	8 0 0
S. Smith (1/–)	9/–	6/–	37½	50	7/6	+1/6	6 13 4
Switchgear & Cowans (5/–)	15/–	10,–	20	20	11/3	—	8 18 0
Telegraph Condenser (10/–)	7/6	5/–	5	—	7/6	—	—
Telegraph Construction	2½	32/6	10	10	32/6	—	6 3 1
Telephone Mfg. (5/–)	10/–	7/–	9	9	8/–	—	5 12 6
Tube Investments	91/–	72/6	23½	23½	85/–	+1/6	5 11 6
Vactric (5/–)	4/3	2/3	10	4	2/6	—	8 0 0
Vickers (10/–)	24/6	14/6	10	10	17/3	—	5 16 0
Ward & Goldstone (5/–)	22/6	19/6	20	20	19/9	—	5 1 3
Westinghouse Brake	54/9	36/–	17½	17½	2½	+½	7 15 6
Walsall Conduits (4/–)	31/9	21/3	55	55	25/–	—	8 16 0
West, Allen (5/–)	7/6	5/9	7½	10	5/9	−6d.	8 14 0

* Dividends are paid free of Income Tax.

CONTRACT INFORMATION

Particulars of work for which tenders are invited, contracts placed, and building schemes promising work for electrical contractors and traders

Contracts Open

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses. Further details of items marked with an asterisk can be obtained from the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, London, S.W.1.

Argentina.—BUENOS AIRES.—Irrigation Department. With reference to memorandum T. 28105/39, the Department of Overseas Trade reports that the closing date for receipt of tenders for generators and switchgear has been extended until December 28th.

Ashbourne.—December 11th. Electricity Department. One six-panel extra-high-voltage switchboard. (See this issue.)

Australia.—MELBOURNE.—State Electricity Commission. The closing date for the receipt of tenders for the supply of two 12,000-kW water-driven turbo-generators (reference T. 25686/39)* has been postponed to January 3rd, 1940.

SYDNEY.—January 4th. Sydney County Council. Electricity Undertaking. Insulating - oil treatment equipment. General manager.

BRISBANE.—January 15th. City Electric Light Co., Ltd. Two steam boilers and accessories. H. Baskerville, secretary, Boundary Street, Brisbane, Queensland.

Belfast.—December 8th. Electricity Department. Fire extinguishing equipment, mercury arc rectifier equipment and other plant. (November 24th.)

Birmingham.—December 8th. Electric Supply Department. High - pressure steam pipework and associated valves and drain pipework for four new boilers and two new turbo-alternators at the Hams Hall "B" power station. (October 20th.)

Birmingham.—December 5th. Salvage Committee. Supply and erection of 150-kVA transformer, glass bulb rectifier and low-voltage cables, with necessary alterations to existing switchgear, at the Brookvale Road Works of the Salvage Department. Specifications (£1 1s. deposit) from general manager, Salvage Department, Corporation Street, Birmingham, 4.

Dublin.—December 14th. Corporation. Two axial-flow sewage pumps, complete with electric motors, switchgear, &c. City treasurer, Exchange Buildings, Lord Edward Street, Dublin (deposit £2 2s.).

Edinburgh.—December 4th. Commissioners of Northern Lighthouses. Renewal of the siren fog signal installations at Inchkeith and Corsewall lighthouses. Particulars from Mr. J. Oswald, engineer to the Board (£2 2s.). Tenders to J. Glencorse Wakelin, secretary, 84, George Street.

Eire.—December 11th. County Donegal Vocational Education Committee. Electric lighting and central heating installations at Stranorlar Technical School; G. V. McLaughlin, architect, Letterkenny.

Hutton (NEAR PRESTON).—December 14th. Lancs C.C. Electric lighting in emergency police headquarters. Mr. S. Wilkinson, County Architect, County offices (deposit £2).

New Zealand.—WELLINGTON.—Public Works Department. January 9th (Extended date). 50-kV outdoor switchgear for Hangatiki sub-station and 110-kV outdoor switchgear and steelwork for Ongarue sub-station. (T. 27495/39.)* Four 10,000-kVA transformer units. (T. 27496/39.)*

January 23rd. Four 110 kV three-phase outdoor isolating switches. (T. 29122/39.)*

February 6th. Two motor driven centrifugal pumps. (T. 29120/39.)*

February 13th. Three single-phase transformer units. (T. 28146/30.)* Two 2,250-kVA three-phase boosting transformers. (T. 28144/39.)* Remote control equipment. (T. 28791/39.)*

February 20th. Seven single-phase transformer units (T. 28148/39.)* Four single-phase transformer units. (T. 28147/39.)*

March 26th. Four single-phase transformer units. (T. 28143/39.)*

March 12th. 110-kV outdoor switchgear and steelwork. (T. 28145/39.)*

January 16th. Two sets of 11,000-V metal-clad switchgear. (T. 28857/39.)*

February 27th. 22,000-V switchgear. (T. 28858/39.)* 11,000-V switchgear. (T. 28789/39.)*

Salford.—Corporation. December 13th. One 150-kW mercury-arc rectifier equipment. (See this issue.)

South Africa.—CAPE TOWN.—January 15th. Electricity Department. Booster pumps, complete with driving motors, &c., and piping, two sets of motor starting and control gear, two 3,300-V iron-clad switchboards, two 380/220-V iron-clad distribution boards and one overhead travelling crane. (T. 27966/39.)*

PRETORIA.—Public Works Department. December 7th. Supply of two double-wound, three-phase, indoor, oil immersed transformers. (T. 28767/39.)*

JOHANNESBURG.—January 6th. Fire-fighting equipment. (T. 28771/39.)*

Stone.—December 9th. U.D.C. Sewage and storm-water pumping plant, with electric motor drive, comprising five vertical-spindle centrifugal pumps in the new pumping station. C. H. Matthews, clerk, Town Hall (deposit £2 2s.).

(Continued on next page)

Financial Section (*concluded from page 718*)

Report and Dividends—contd.

amount of £5,000 to the central benevolent fund. The balance carried forward is £81,392.

The British Electric Transformer Co., Ltd., reports, in a preliminary statement, a profit for the year to September 30th of £79,736, as compared with £79,681 for 1937-38. Dividends are declared at the rate of 5 per cent. on the cumulative preference shares in respect of the year, and at the rate of 1s. per share actual (free of tax) on the ordinary shares, making, with the interim dividend, 3s. 6d. per share (free of tax) for the year. The balance carried forward is £2,105.

The Associated Equipment Co., Ltd., reports a trading profit for the year ended September 30th of £447,894, an increase of £70,149, as compared with the preceding year, and after adding a net credit of £6,000 from the sale of fixed assets and including interest, the total profit is £457,200. After providing for taxation (£172,600), depreciation (£103,000), and directors' fees (£2,100) there is a net balance of £179,500, an increase of £2,000. The total dividend for the year is maintained at 7½ per cent., tax free, equal to about 11½ per cent. gross, and after placing £65,000 to reserve and crediting £262,000 brought in a balance of £264,000 is carried forward.

Sydney S. Bird & Sons report a profit, after providing for depreciation, of £8,063 for the year to September 30th, as compared with £10,553 for the preceding year. Directors' fees require £350, tax and N.D.C. £3,413, and, as we have already reported, the final ordinary dividend is 7½ per cent., making 12 per cent. for the year (against 17½ per cent.). The balance carried forward is £2,600 (against £2,550 brought in).

Electric & Musical Industries, Ltd., reports that a fall in sales was the primary cause of the loss of £131,968 for the year to September 30th, which with the net preference dividends makes £150,426. This is deducted from £298,418 brought in, leaving a balance to be carried forward of £147,992. The report states that during 1938-39 the sales of the company's normal products were adversely affected by the disturbed conditions prevailing both in the home and overseas markets. Other work has, however, been found for the factories. The assets of the operating companies in Germany, Austria and Poland had previously been written off. The possible loss of assets in Czecho-Slovakia has been fully provided for in the accounts under review.

Tube Investments, Ltd., reports that dividends received from subsidiary, allied and associated companies amounted to £840,860 for the year ended October 31st, an increase of £5,501 as compared with the previous year, and after adding bank interest, &c., there is a balance available of £887,834 (against £883,726). As already announced, the final ordinary dividend is 13⅜ per cent., less tax at 7s. (with the same rate relatively on the liaison ordinary shares), again making 23⅜ per cent. The balance carried forward is £151,332, as compared with £132,132 brought in.

Ensign Lamps, Ltd., reports a profit for the year to June 30th, after meeting expenses of working and management, of £33,975, as compared with £31,352, plus bank interest and transfer fees £35. Directors' fees require £262 and tax £17,000, and it is proposed to pay a final dividend of 15 per cent. on the ordinary shares, making 25 per cent. for the year (same). General reserve receives £4,500 and £10,994 is carried forward (against £11,446 brought in).

The Wessex Electricity Co. held an extraordinary meeting on Tuesday last to pass a resolution to create and issue 1,000,000 ordinary shares, entitled to the same rights and privileges as the existing ordinary shares.

John Shaw & Sons, Wolverhampton, are paying a dividend on the ordinary shares of 4 per cent. (same) for the year to June 30th.

The Radio Corporation of America has declared a dividend on the common shares of 20 cents for 1939. This is at the same rate as for 1938.

Aron Electricity Meter, Ltd., announces that in view of the falling off of sales of electricity meters the directors have decided to postpone consideration of a dividend until the accounts for the year to March 31st, 1940, have been received. Last year an interim dividend of 5 per cent. was paid.

W. & T. Avery, Ltd., are maintaining their interim dividend at 5 per cent.

Radio Rentals, Ltd., is paying a final ordinary dividend of 4½ per cent. (against 3½ per cent.), making the total distribution for the year 7½ per cent. (against 6½ per cent.).

The India Rubber, Gutta Percha & Telegraph Works Co., Ltd., reports a net profit for the year ended September 30th of £60,485, as compared with £32,608 in the preceding year.

Edmundsons Electricity Corporation, Ltd., is again paying an interim dividend of 2½ per cent. on the ordinary stock.

Dictograph Telephones, Ltd., has announced a first and final dividend of 7 per cent. for the year to August 31st (against 10 per cent.). The net trading profit was £27,473 (against £30,551).

George Kent, Ltd., are paying an interim dividend of 3 per cent. (same).

The General Cable Manufacturing Co., Ltd., has declared a final dividend of 6 per cent., maintaining the distribution for the year at 12 per cent.

Wolverhampton.—December 18th. West Midlands Joint Electricity Authority. Coal storage plant for Ironbridge power station. (November 24th.)

Orders Placed

Bedford.—Electricity Committee. Recommended. Battery repairs (£237).—Chloride Electrical Storage Co.

London.—L.C.C. Education Committee. Wiring and fitting for electric light and power and fire alarm system at Banstead residential school, Surrey (£3,886), and rewiring of electrical installation, &c., Hutton residential school, Essex (£4,015).—Read & Partners. Wiring and fittings for electric light and power at Norwood children's home (£2,154).—A. Meckhonik. Electrical installation at Norwood Technical Institute (£1,507).—W. G. Perry & Co. Electric lighting installation at new school on the Oldhill Street site, Hackney (£1,151).—Colston Electrical Co.

Electric wiring and fittings at L.C.C. School of Engineering and Navigation Poplar (£1,086).—Buchanan & Curwen. Installation of electricity at Westminster Technical Institute (£3,008).—Electrical Installations, Ltd.

Hospitals and Medical Services Committee. Accepted. Wiring and fittings for electric lighting and call bells, Northern Hospital (£1,767).—William Steward & Co. Electrical installation at St. Clements Hospital (£594).—Samuel Reed & Sons. Electrical installation at St. Giles' Hospital (£898).—Duncan Watson (Electrical Installations). Wiring and fittings for automatic telephone system at St. Nicholas' Hospital (£1,283) and electrical installation at Southern Hospital (£2,310).—Read & Partners. Electrical installation at South-Eastern Hospital (£850).—Newman & Watson.

Housing and Public Health Committee. Accepted. Electrical installations:—Battersea Bridge Buildings (£757).—Newman and Watson. Becontree (56 houses and 21 garages) (£725).—Evans & Shea. Blackstock estate, Islington (£1,314).—Samuel Reed & Sons. Chicksand estate, Stepney (blocks 1 and 2) (£1,370).—Pemberton & Sturgess (Gt. Britain). Gascoyne estate, Hackney (blocks 1, part, and 3) £1,875).—Newman & Watson. Ryhill estate, Camberwell (blocks 1 and 2) (£1,084).—A. Meckhonik. South Lambeth estate (£3,236).—Holliday & Son (Electrical).

Mental Hospitals Committee. Accepted. Wiring and fittings for electric lighting, clock and power wall sockets, telephones, fire alarm and door bell systems at Darenth Park Hospital (£1,109).—Read & Partners. Wiring and fittings for electric lighting, power and fire alarm system, Fountain Hospital (£3,285).—Buchanan & Curwen. Wiring and fittings for electric lighting, power, telephones and fire alarms, Leavesden Hospital (£519).—Troughton & Young.

HAMMERSMITH.—Executive Committee. Accepted. Replacing current transformers and protective relay on one of the feeder switches at Wood Lane substation (£216).—A. Reyrolle & Co.

ST. MARYLEBONE.—Electricity Committee. Recommended. House service meters for twelve months at revised schedule prices.—Chamberlain & Hookham, Ltd.; Ferranti, Ltd.

South Africa.—CAPE TOWN.—Electricity Committee. Accepted. Switchgear (£13,337).—A. Reyrolle & Co. Transformers: Four 100 kVA (£292).—W. D. Hearn & Co., Ltd.; two 450-kVA (£201).—British General Electric Co.

Contracts in Prospect

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Aberdeen.—Police buildings at Central Police Office; city architect.

Angus.—Police station, &c., at Montrose (£10,000), for County Police Committee; J. McGregor, Master of Works, County Offices, Forfar.

Barking. — Town hall up to lower ground floor, including A.R.P. accommodation; borough surveyor.

Alterations, Westbury School (£7,133); borough surveyor.

Barnsley. — Deep shelters (£15,900), Queen's Road and Barrasclough Foundry sites; borough surveyor.

Barnstaple. — Extensions to North Devon Infirmary.

Birmingham.—Decontamination centre at Thornhill Road (Handsworth) police station; H. J. Manzoni, city engineer, Council House.

Bradford.—Factory, for A. Riddell & Co., Ltd., East Parade.

Brentwood.—Estate development, Warley Place; A. T. Carter.

Burgess Hill.—Catholic church; J. B. Mendham, architect, 4, Elm Park Gardens, London, S.W.10.

Caernarvonshire.—Casual ward, Penrhyn estate, Talybont, for C.C.; County architect, County Offices, Caernarvon.

Cannock (STAFFS).—Isolation Hospital on Lysway site for Mid-Staffordshire Joint Hospital Board; S. N. Cooke and W. Norman Twist, architects, Sun Buildings, Bennett's Hill, Birmingham.

Cornwall.—Isolation hospital (£19,000), East Cornwall, for Joint Hospital Board; county architect, County Hall, Truro.

Croydon.—Houses (66), flats and shops, West Croydon redevelopment scheme (£32,000); borough surveyor.

Doncaster.—Extensions to Royal Infirmary (£20,000); H. Arnold & Son, Ltd., contractors, Printing Office Street.

Droitwich.—Cycle works, part of old workhouse site, for W. A. Lloyds Cycles, Ltd., Freeman Street, Birmingham.

Dundee.—Operating theatre at Maryfield Hospital (£3,000); city architect.

Easington.—Bus station; R.D.C. surveyor.

Houses; R.D.C. surveyor.

East Sussex.—Senior school at Portslade, for East Sussex C.C.; county architect, Lewes.

Eccles.—Warehouse, Monton Fields Road; E. Taylor, Ltd.

Works additions, Monton Fields Road; Hill & Hiley, Ltd.

Works additions, Shakespeare Crescent; C. & W. Pickup.

Edinburgh.—Reconstruction of buildings, Lochrin Terrace; J. Smith & Co. (Paper), Ltd.

Glasgow.—Extension to garage at Govan, for Corporation; forms of tender for various works (£2 2s.) from Office of Public Works, City Chambers (Room 81).

Store, Lendel Place, Brand Street, for Connal & Co., Ltd., 34, West George Street.

Hampshire.—Police station at Andover; county architect, Winchester.

Heywood.—Public shelters; borough surveyor.

Hulme Walfield (CHESHIRE).—Development, Giantswood Lane, for H. G. Varden; A. R. Biggs.

Kent.—Completion of buildings at Chartham Mental Hospital, including convalescent villas and admission hospital, for C.C.; county architect, Springfield, Maidstone.

Five divisional A.R.P. centres (£10,250); county architect.

Additions to Barming Hospital (£16,600); county architect.

Lancashire.—Cleansing station, Wright Street, Stretford, for C.C.; county architect, County Offices, Preston.

Lewdown (DEVON). — Alterations to Royal Exchange Inn, for Plymouth Breweries, Ltd.; C. W. Parkes Lees & Son, architects, 27a, Fore Street, Fowey, Cornwall.

Liverpool. — Decontamination centre, Rice Lane, for Dunlop Rubber Co., Ltd., 24, Cornhill.

London. — CHELSEA.—Depôt, Denyer Street, for B.C.; J. Alex. Gough, architect, Town Hall, King's Road, S.W.3.

BERMONDSEY.—Factory, East Lane; Stanley Hicks & Son, surveyors, 113, Cannon Street, E.C.4.

Warehouse, Channel Row; Hal Williams & Co., architects, 43, Bedford Square, W.C.1.

ROTHERHITHE. — Church and hall, Rotherhithe Street; Arnold, Fooks, Chadwick & Co., 15, Bolton Street, W.1.

Longton. — Parish church (£10,400); Rev. C. K. Lane, Edensor, Longton, Staffs.

Manchester.—Extensions to premises for the Failsworth Industrial Society, Ltd., 9, Church Street.

Emergency hospital buildings at Baguley Sanatorium; J. Gerrard & Sons, Ltd., contractors, Pendlebury Road, Swinton, Manchester. Electrical work.

Margate.—Surface shelter for sixty-six persons, Ramsgate Road, for T.C.; W. L. Armstrong, borough engineer, 40, Grosvenor Place.

Middlesbrough. — Houses, Cambridge Road, for W. Robinson; T. Crawford, architect, 82, Borough Road, Middlesbrough.

Shelters for Newhouse, Ltd., Newport Road (Archibald & Archibald, 25, Albert Road, Middlesbrough); and Constantine Shipping Co., Borough Road (Kitching & Co., architects, 21, Albert Road).

Middlewich.—Alterations, Union Bank of Manchester, High Town; R. Stubbs, architect.

Midleton.—Houses (16), for the U.D.C.; engineer, Council Offices.

Newcastle-on-Tyne.—Hotel, Mill Lane, Newcastle, for Calders, Ltd.; Tait & Holmes, builders, Benwell Village, Newcastle-on-Tyne.

Rebuilding premises of Avon India & Rubber Co., Oxford Street; H. Wiles, architect, 658, Durham Road, Low Fell.

Nottinghamshire. — School canteens, Kimberley & Selston (£2,900); county architect.

Oakengates. — Works, Snedshill, for John Maddox & Co., Malleable Iron Foundry.

Oxford.—Extensions to Municipal College (£45,000).

Ravensworth (Co. DURHAM).—Welfare hall for the local miners' welfare committee; E. Cowen, trustee, Ravensworth.

Richmond-on-Thames. — School, Ham, for C.E. Authorities; J. D. Mathews & Sons, architects, 3, Ebury Street, S.W.1.

Ripponden.—Extensions, Krumlin Mills, for Edmund Sykes & Sons, Ltd., Barkisland, Ripponden.

Ruswarp (YORKS).—Village hall; A. E. Young, architect, 3, Mayfield Road, Whitby.

Sandown-Shanklin.—Development, Cliff Bridge, and Luccombe Village Estate; C. S. Best, Luccombe, Shanklin.

Slough.—Factory building, Station Road, Langley; Pasolds, Ltd.

Factory buildings, 258b, Ipswich Road, and 593-4, Bath Road, Slough; Slough Estates, Ltd.

Spenborough. — Senior school for Gomersal and Birkenshaw; Howarth & Walker, architects, Albion Street, Cleckheaton.

Staffordshire.—Shelters (£208,000), for C.C.; county architect, County Buildings, Stafford.

Stretford.—Additions to works, Ayres Road, for National Corrugated Paper Co., Ltd., Old Trafford.

Stokesley.—Houses, Newton Road, for W. Winn; Kitching & Co., architects, 21, Albert Road, Middlesbrough.

Taunton.—Factory, Stone Gallows Hill, for Muirhead & Co., Ltd., Beckenham, Kent; H. S. W. Stone & Partners, architects, Lloyds Bank Chambers, Taunton.

School at Galmington; borough surveyor.

Urmston.—Extensions to works, for Superheater Co., Ltd., Mellors Road, Trafford Park.

Wellingborough. — Cleansing depôts, Cannon Street and Finedon; U.D.C. surveyor.

Whitehaven.—Welfare centre for the Miners' Welfare Committee; J. C. Cryer & Son, builders, Fleetwood.

Wigan.—Air-raid shelters, for R.D.C.; J. Holding, surveyor, Parbold Hall, Appley Bridge, Wigan.

Wisbech.—Cubicle block, for Wisbech Joint Isolation Hospital Board.

Bungalows (16), Quakers Lane; H. Johnson & Sons.

Worcestershire.—First-aid posts, cleansing depôts, shelters, &c. (£80,000), for C.C.; county architect, 38, Foregate Street, Worcester.

Workington.—Extensions to Infirmary; Oldfield, Simpson & Paul, architects, John Street.